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Appendixes

DRAFT

West-Central Colorado Coal

Environmental Statement



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V.3
C.2

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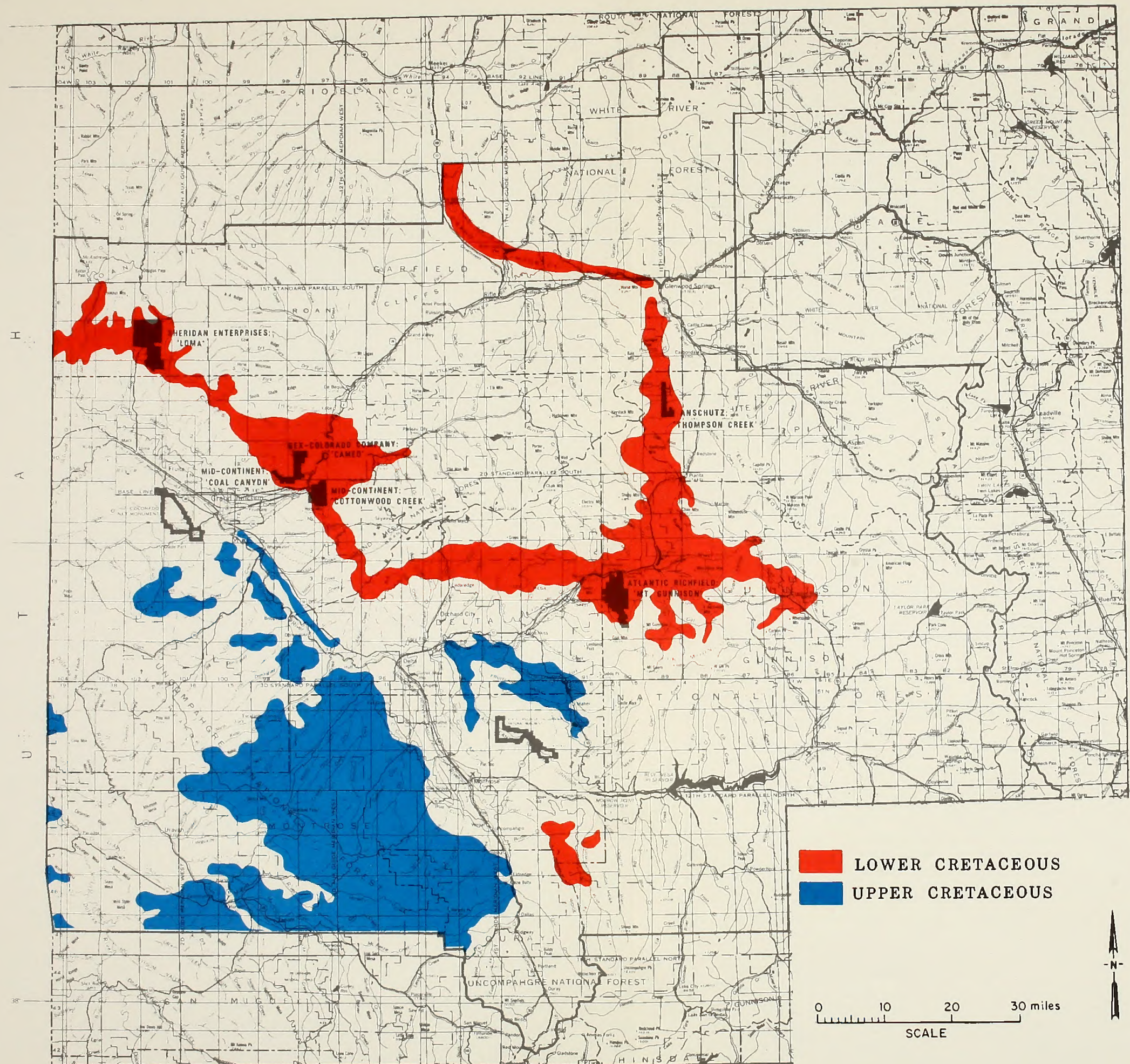
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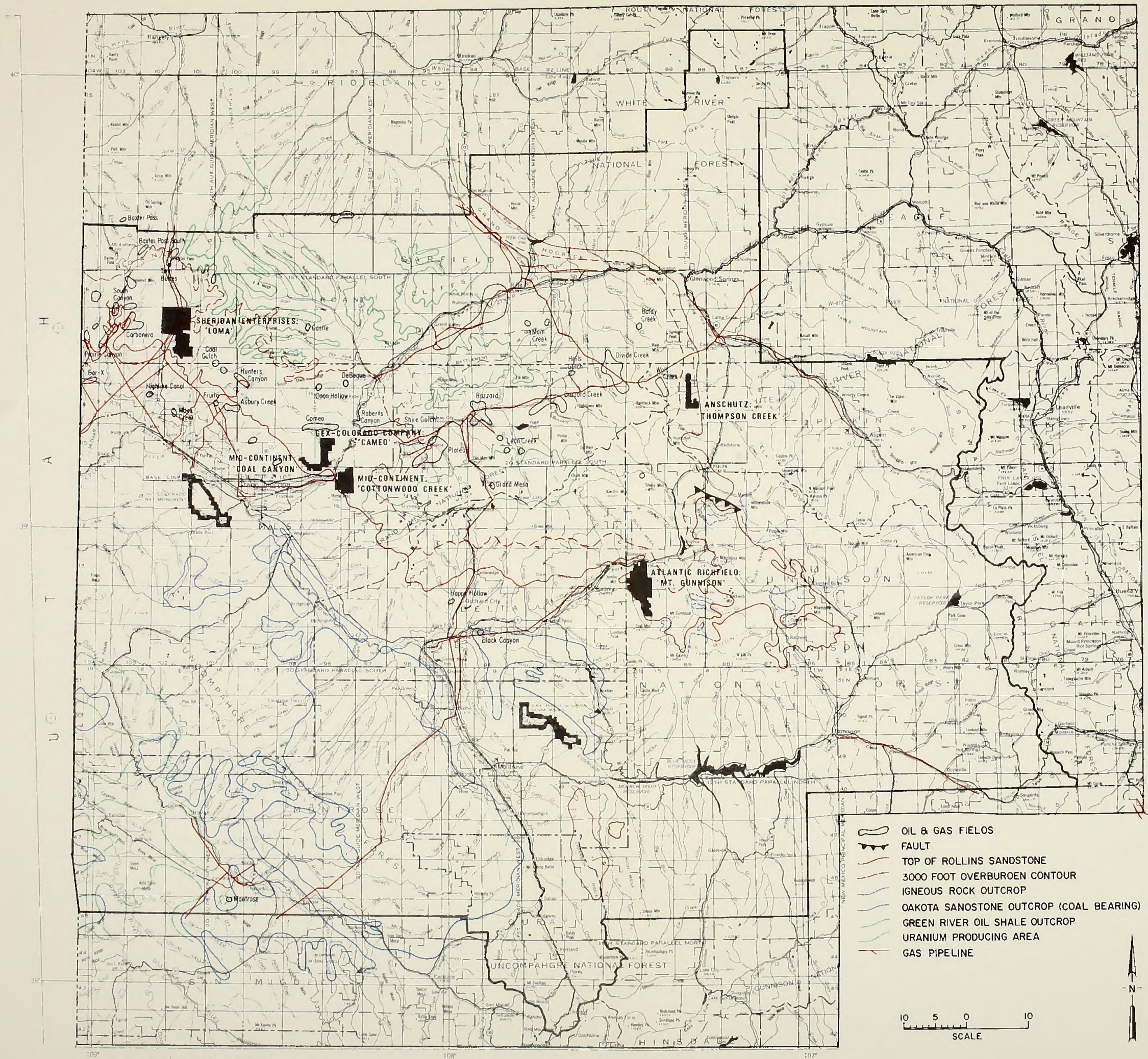
APPENDIX A

Maps 1 and 4 and Figure 2 are in the packet
on the back page of this volume.

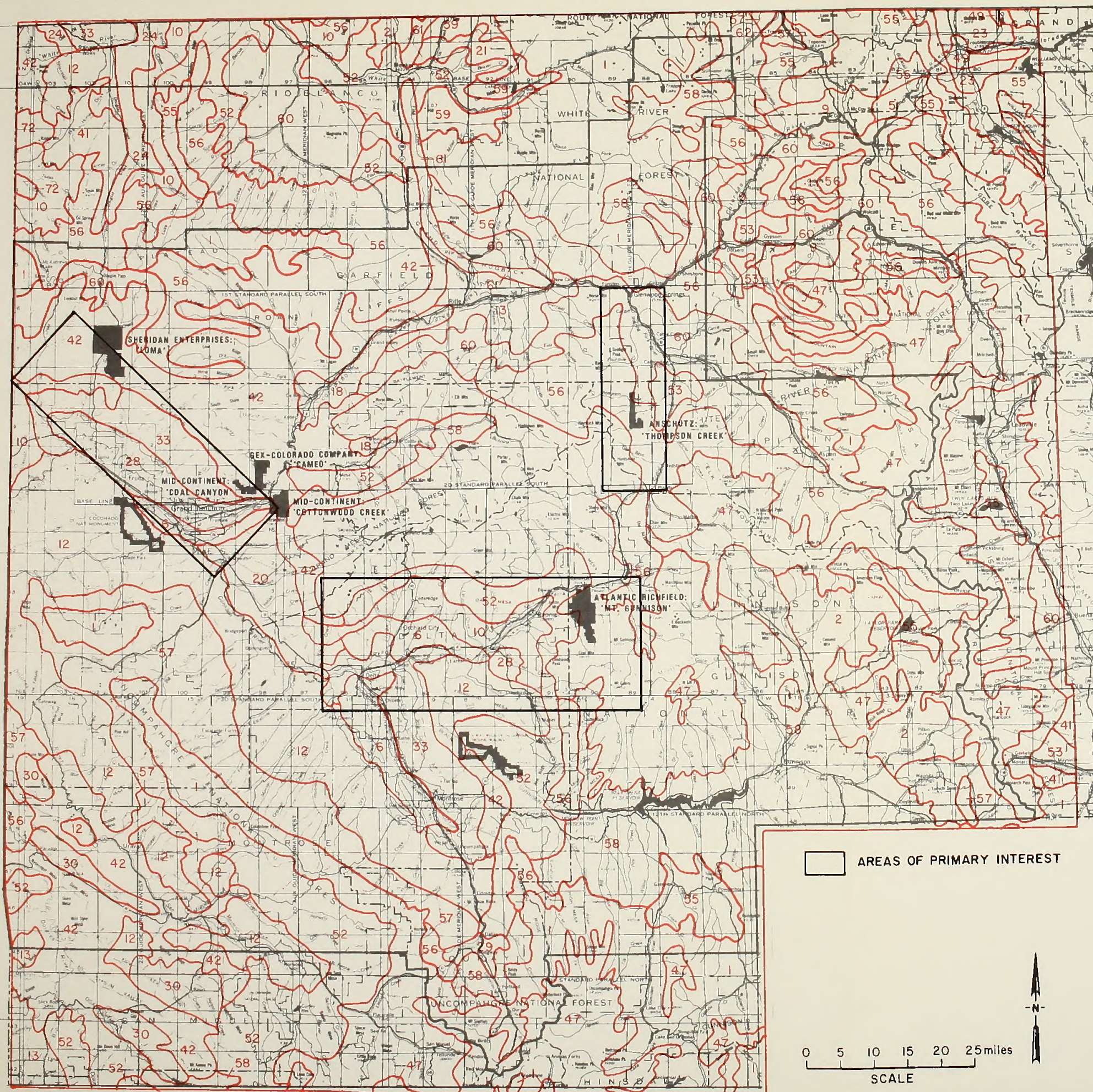
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Map 3. Energy resources in the ES area



LEGEND

Alfisols

1. Typic Cryoboralfs, skeletal - Rock Outcrop: sloping to steep
2. Typic Cryoboralfs, loamy: sloping to steep

Aridisols

6. Typic Haplargids: loamy; nearly level and gently sloping
10. Ustollic Haplargids: loamy; nearly level to gently sloping
12. Ustollic Haplargids, loamy - Rock Outcrop: gently sloping to steep
13. Ustollic Haplargids, silty - Ustollic Haplargids, loamy - Ustic Torriorthents, silty; nearly level to sloping
18. Ustollic Natrargids, clayey - Ustollic Haplargids, loamy: nearly level to sloping
20. Typic Calciorthids, skeletal - Ustic Torriorthents, loamy: gently sloping to moderately steep

Entisols

28. Typic Torrifluvents: silty; nearly level
29. Ustic Torrifluvents, loamy - Typic Fluvaquents, clayey: nearly level and gently sloping
30. Ustic Torrifluvents: loamy; nearly level and gently sloping
33. Typic Torriorthents (shallow): clayey; gently sloping to steep
42. Lithic Ustic Torriorthents, loamy - Rock Outcrop: gently sloping to steep

Inceptisols

47. Pergelic Cryumbrepts, skeletal - Pergelic Cryochrepts, skeletal - Rock Outcrop: sloping to steep

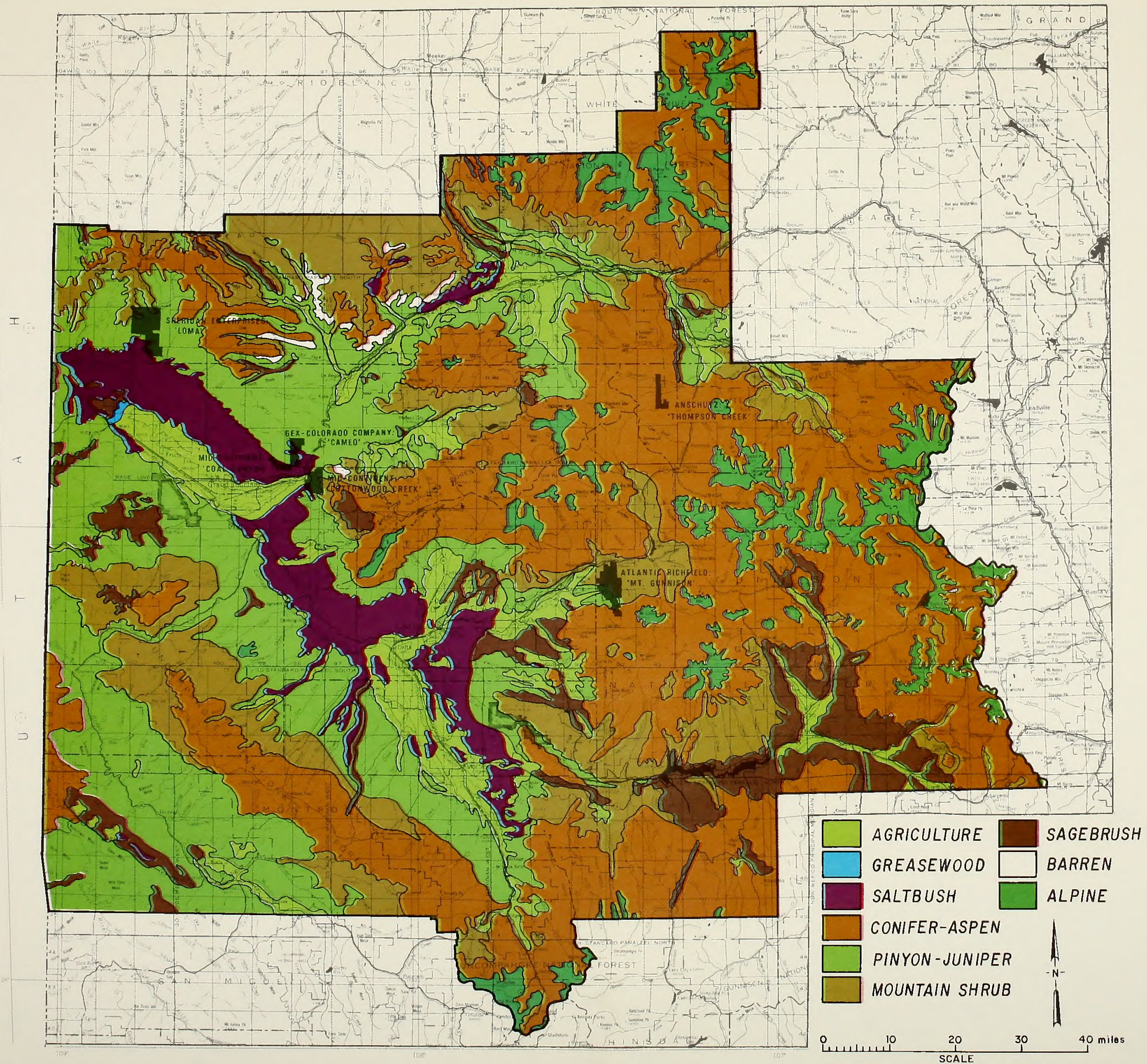
Mollisols

52. Aridic Argiborolls - Aridic Haploborolls: clayey, gently sloping to steep
53. Aridic Calciborolls, skeletal - Aridic Calciborolls, loamy: sloping to steep
55. Typic Cryoborolls, loamy - Rock Outcrop: sloping to steep
56. Typic Cryoborolls, clayey - Typic Cryoboralfs, skeletal: moderately steep to steep
57. Typic Cryoborolls - Typic Cryorthents: clayey; sloping to steep
58. Argic Cryoborolls - Typic Cryoborolls: loamy; gently sloping to steep
60. Aridic Haploborolls, loamy - Torriorthentic Haploborolls, loamy - Aridic Argiborolls, clayey: gently sloping to steep
61. Lithic Haploborolls, skeletal - Rock Outcrop: moderately steep to steep

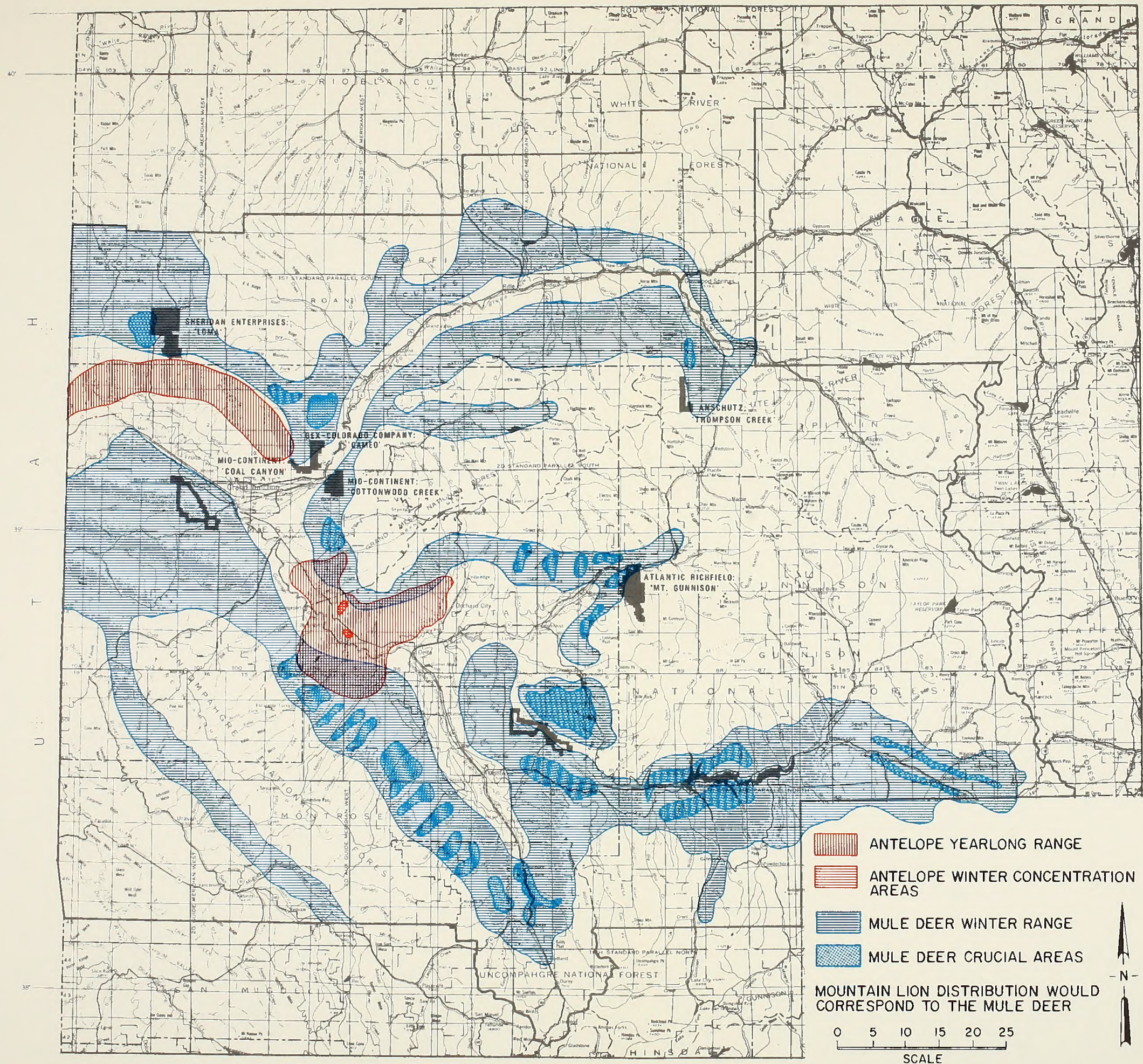
AREAS OF PRIMARY INTEREST

0 5 10 15 20 25 miles
SCALE

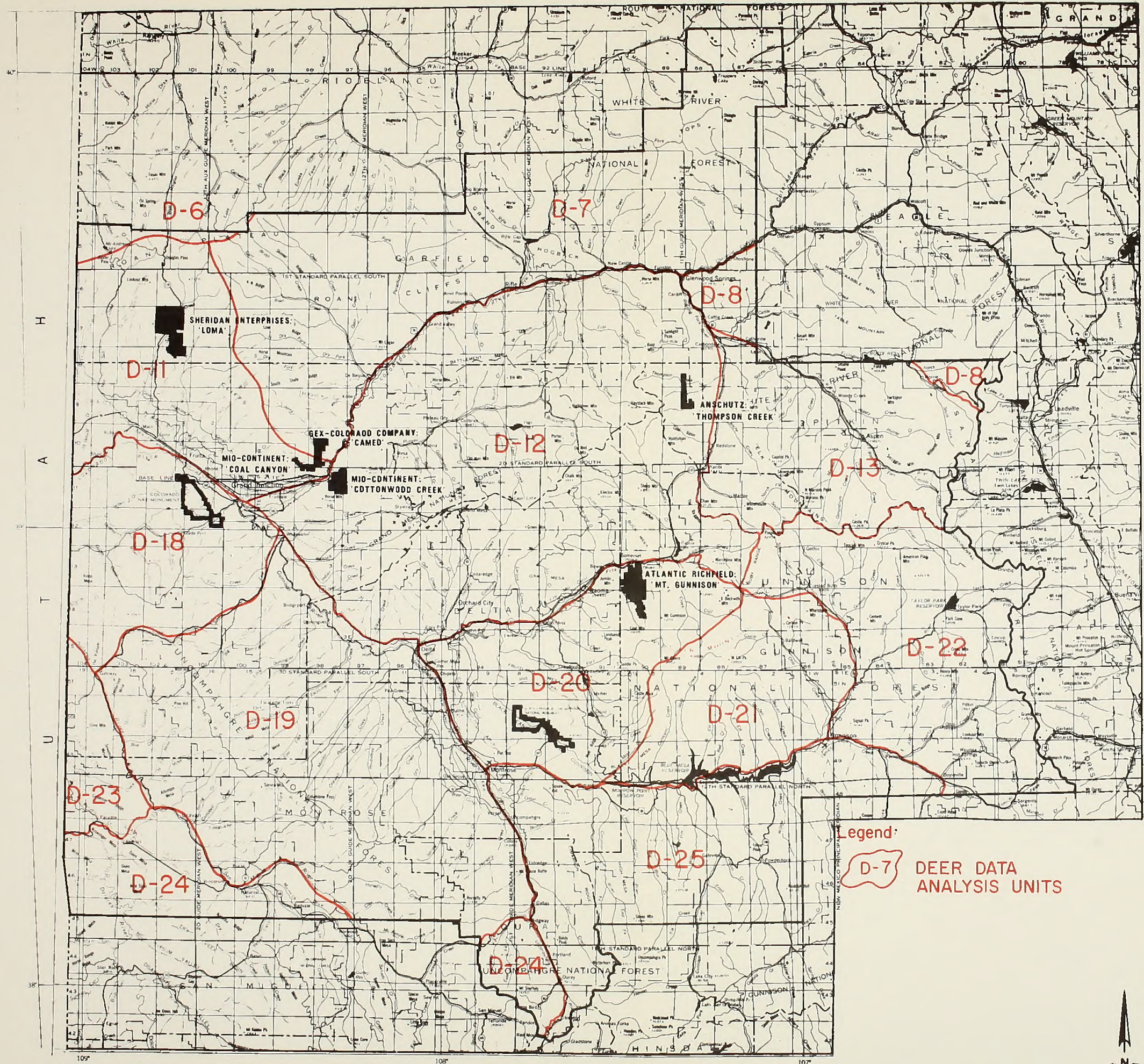
Map 5. General soils map of the ES area
(Heil et al. 1977)



Map 6. General vegetation map of the ES area

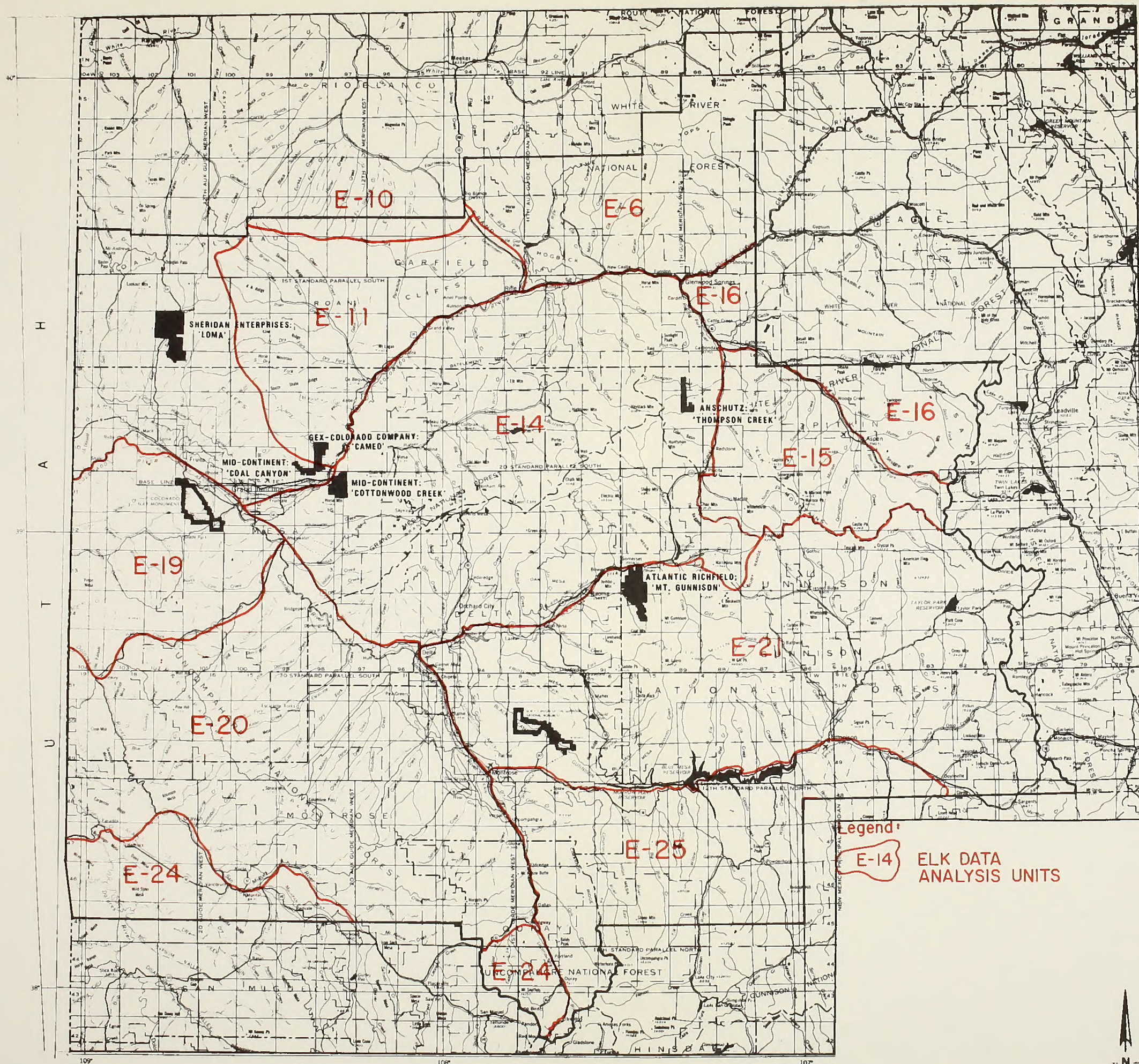


Map 8. Wildlife ranges in the ES area:
antelope, deer, mountain lion



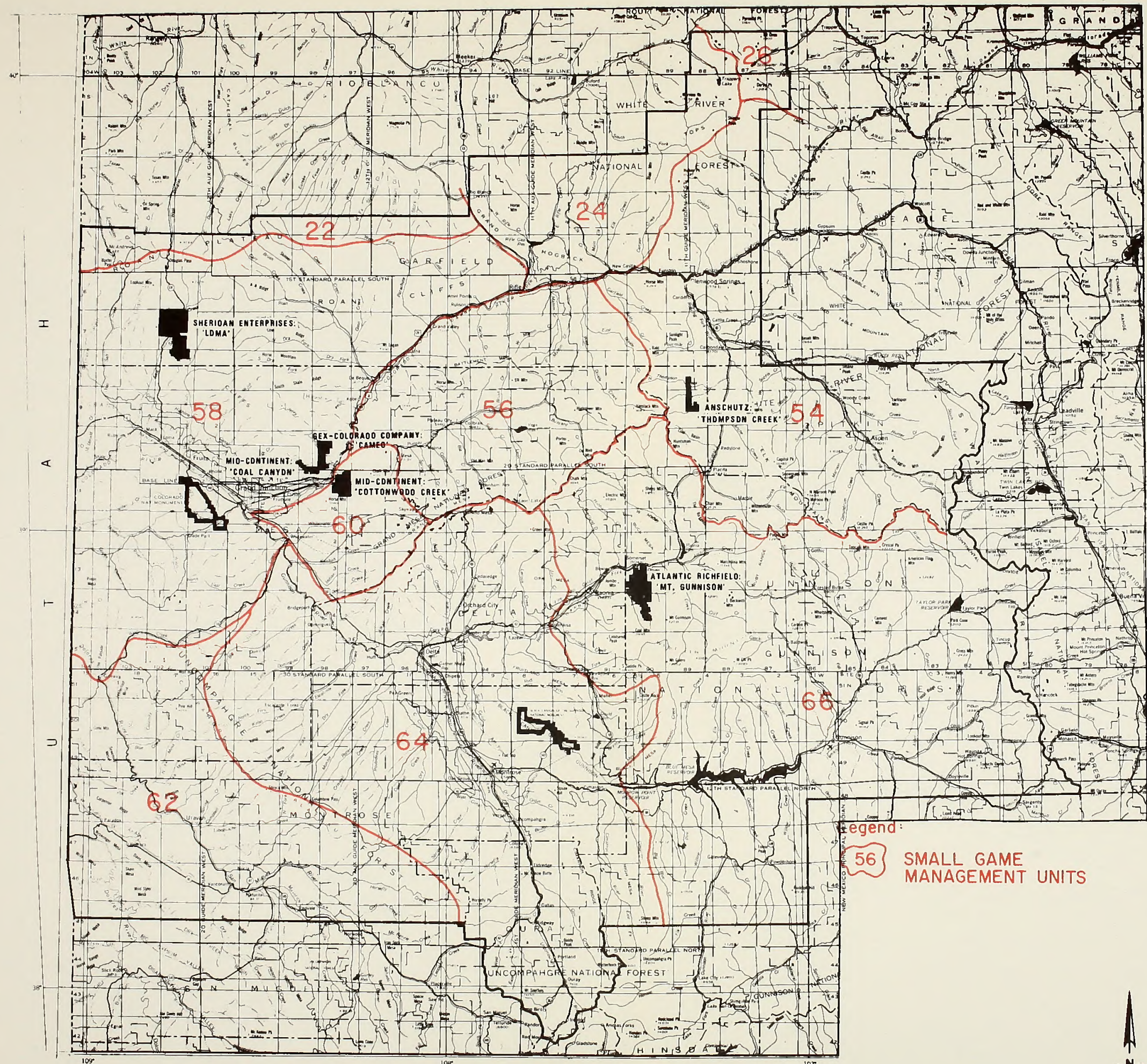
Map 10. Deer data analysis units

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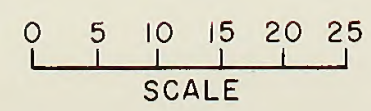


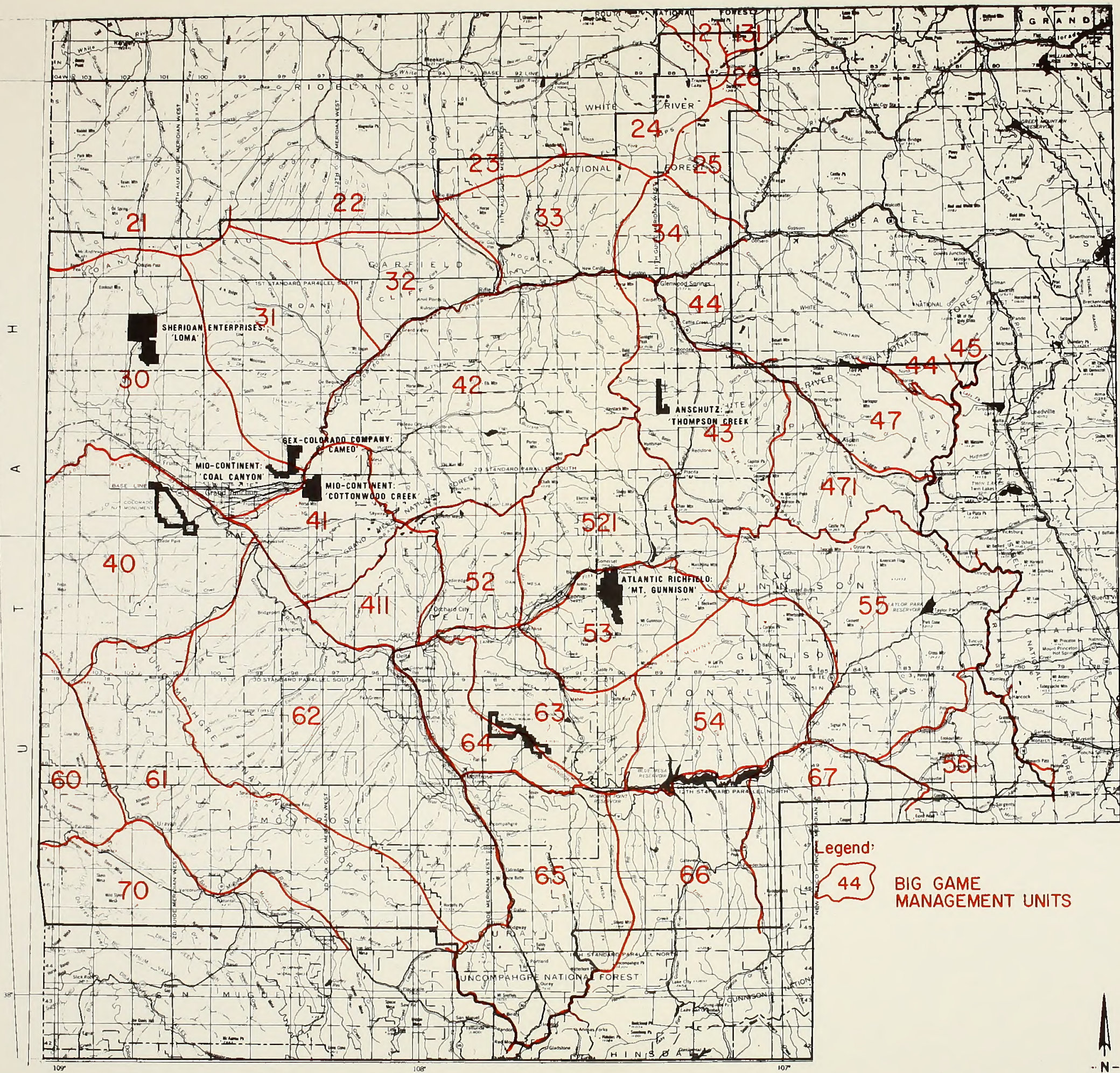
Map 11. Elk data analysis units

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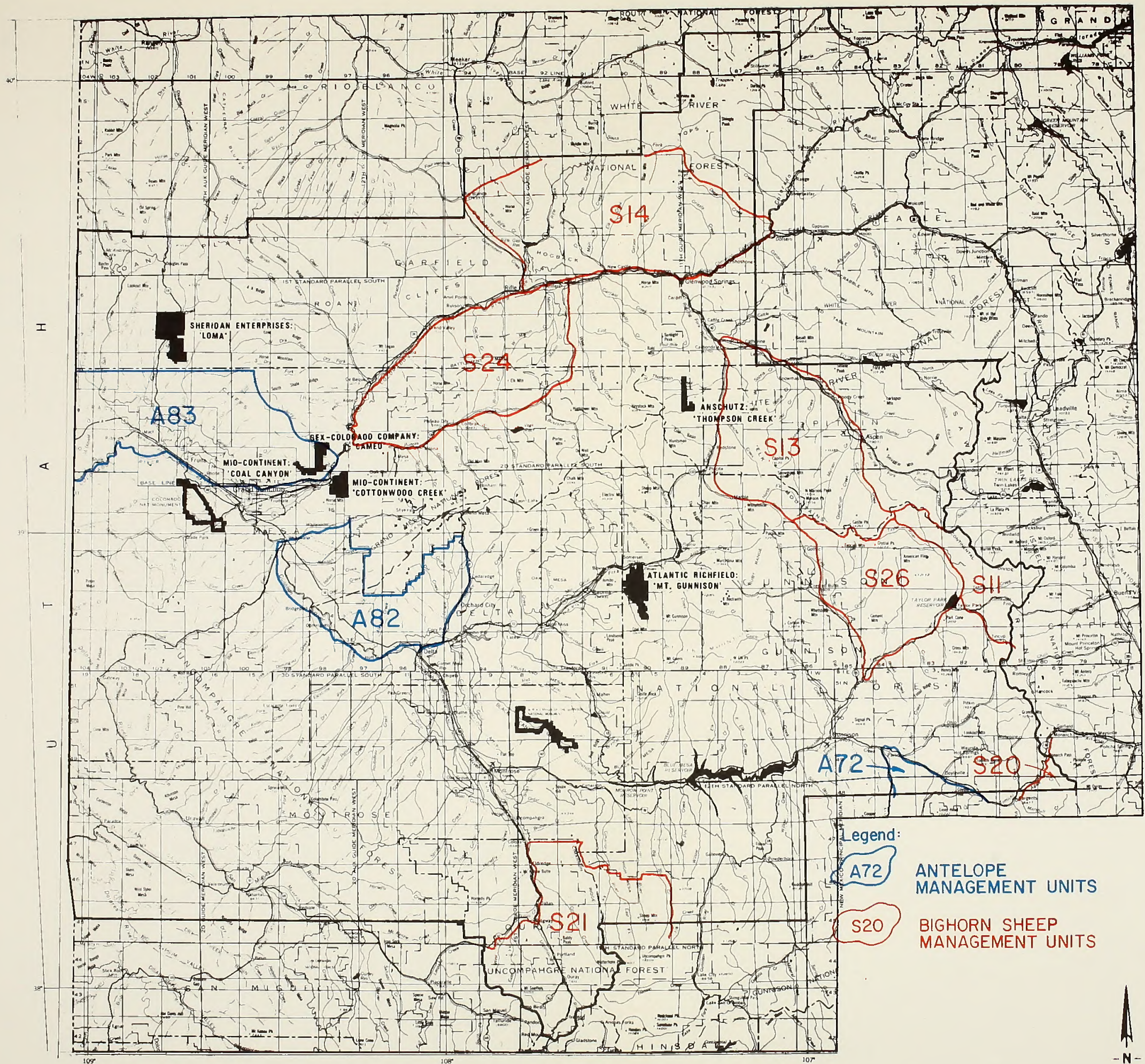
Map 12. Small game management units





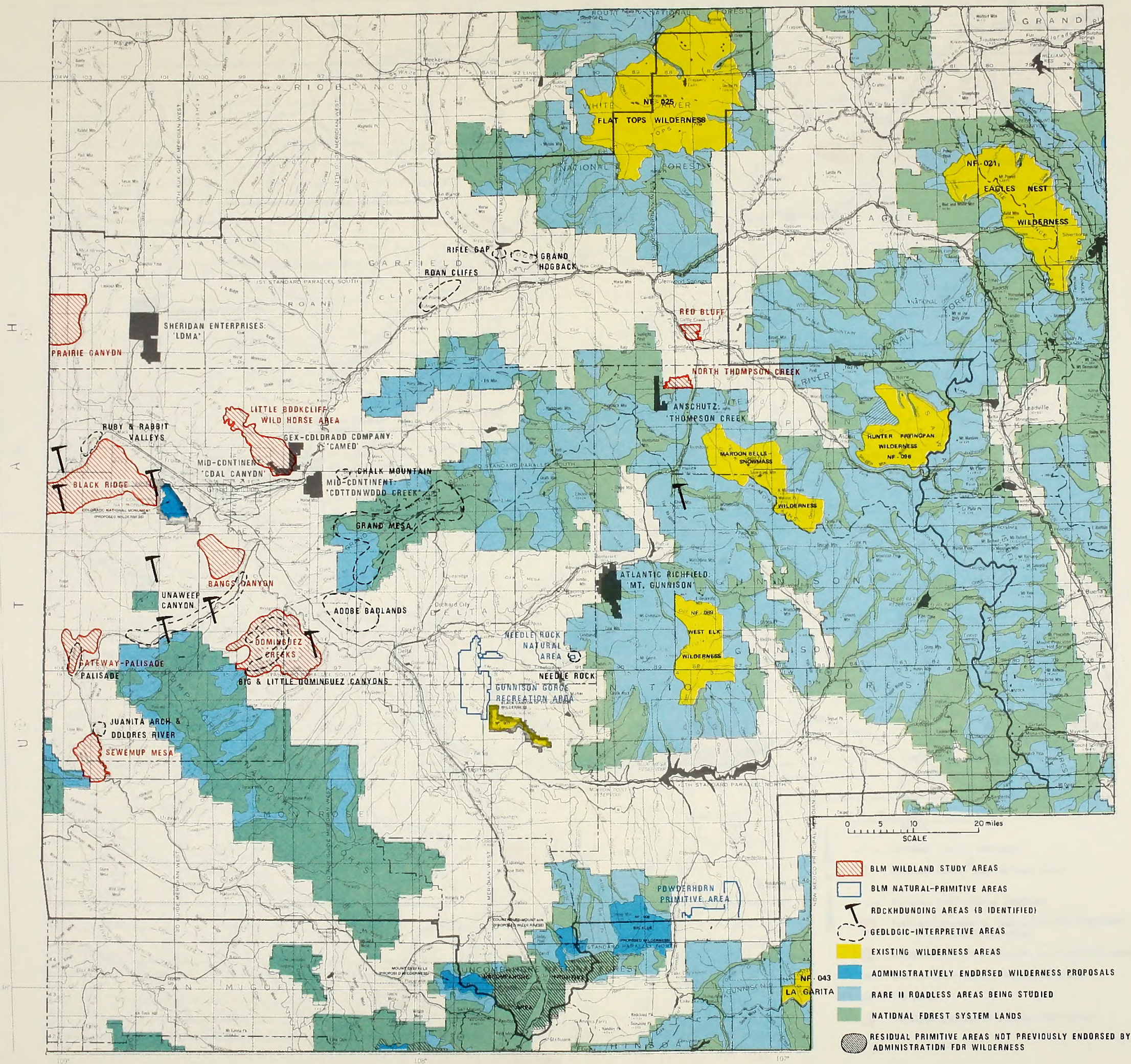
Map 13. Big game management units

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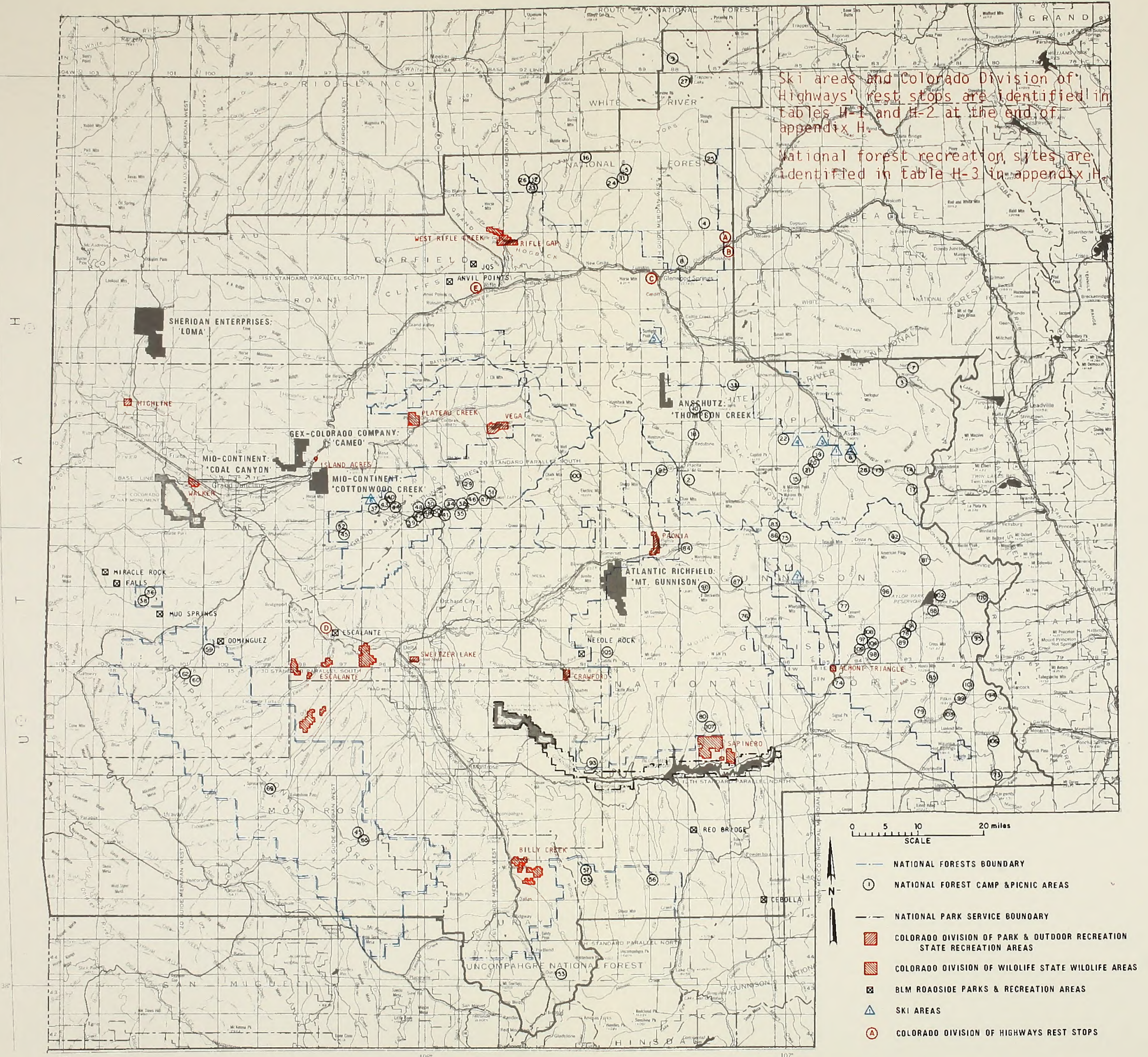


Map 14. Antelope and bighorn sheep management units

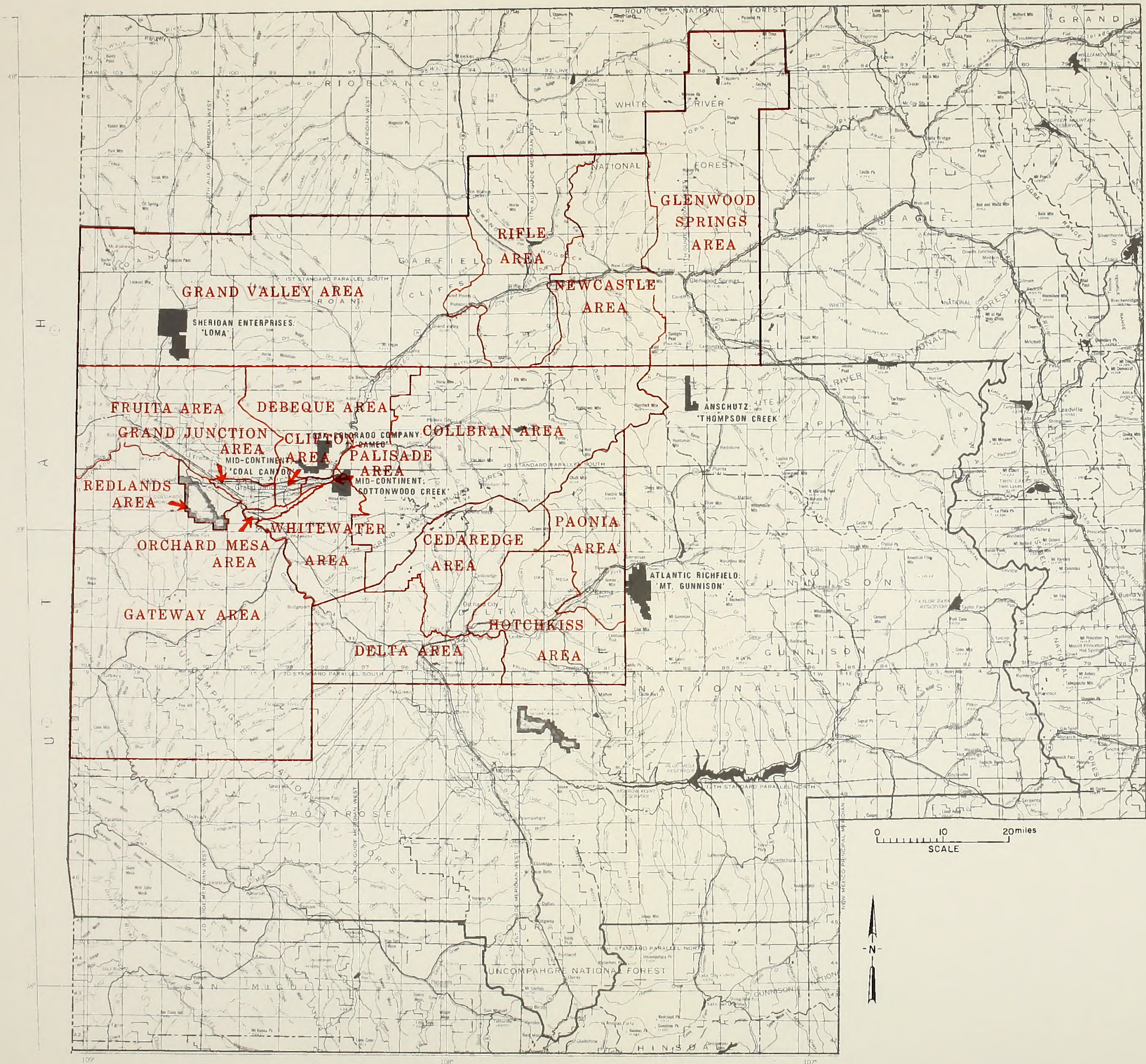
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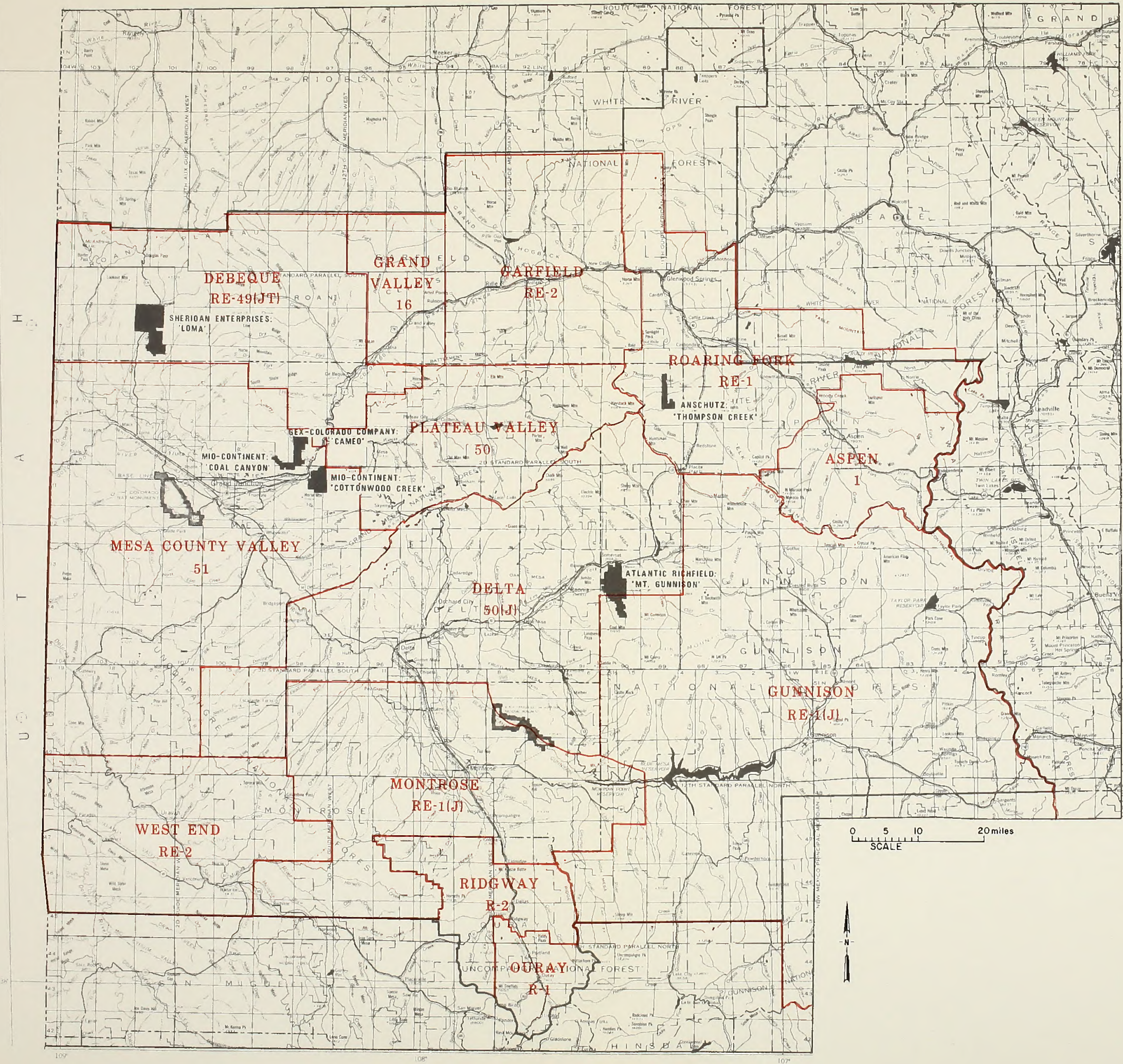
Map 15. Recreation resources of the ES area



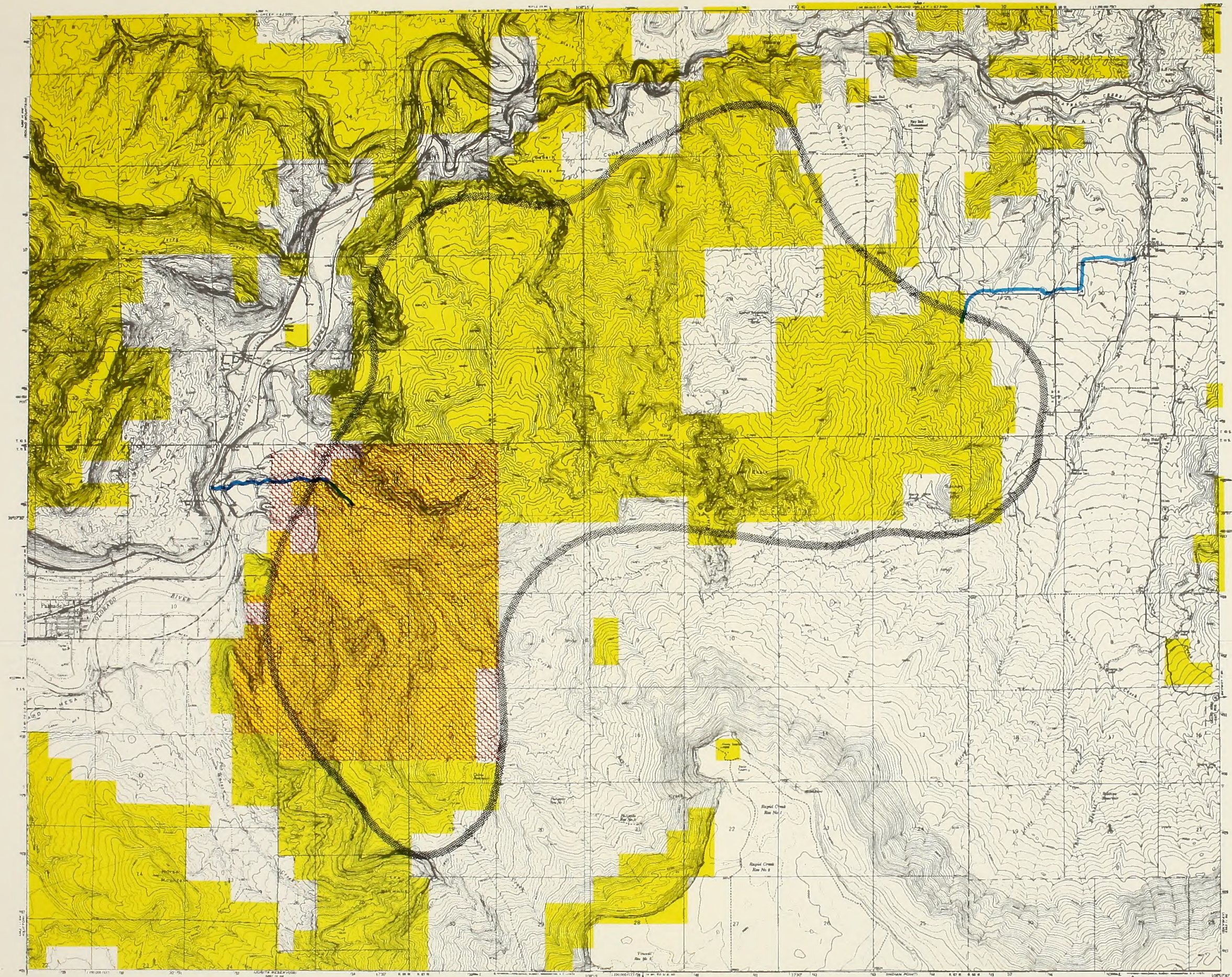
Map 16. Recreational facilities of the ES area







Map 17. County census areas of the ES area



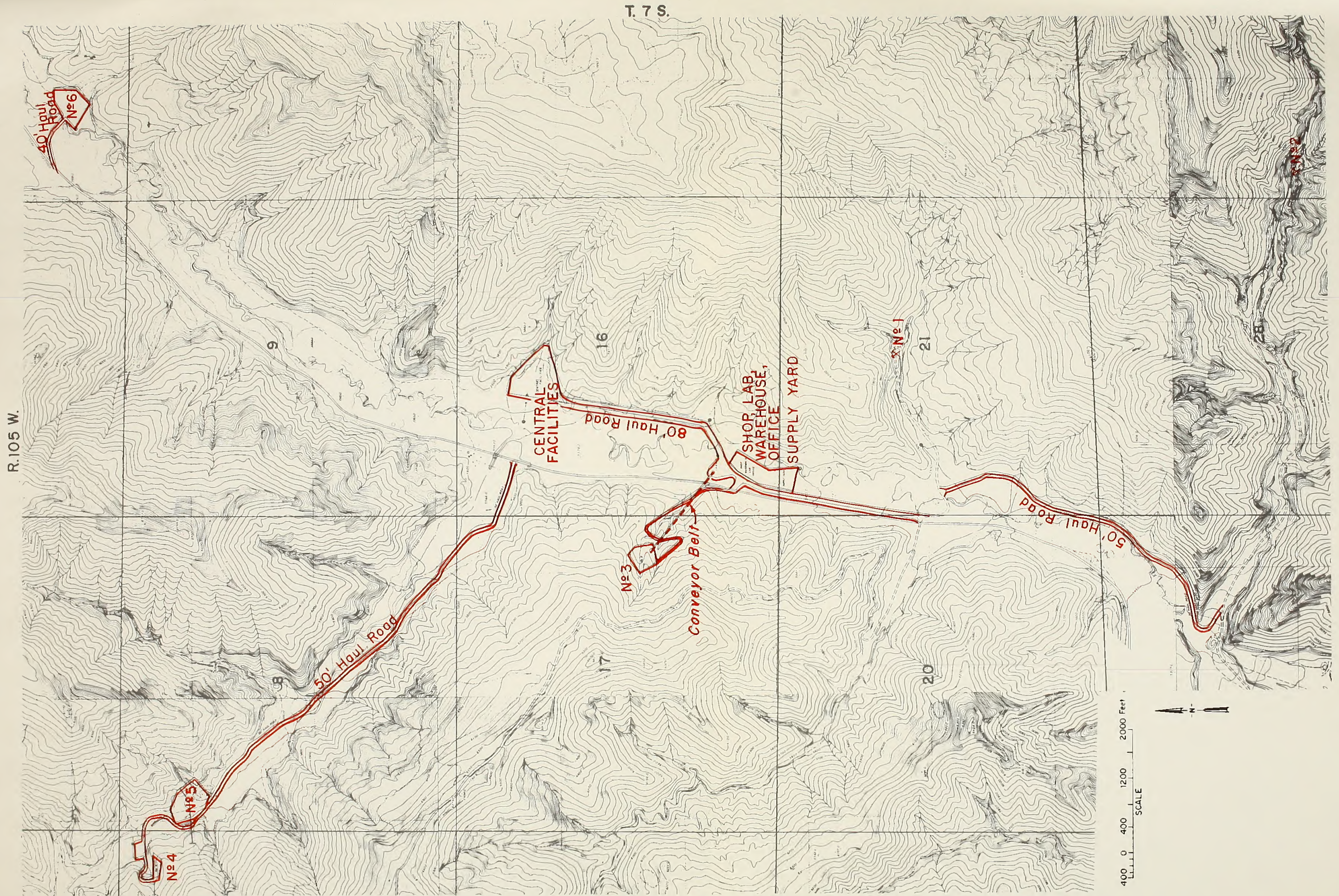
Map 18. School districts of the ES area



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 LEASE SITE

 ACCESS ROUTE (PROPOSED)
 ACCESS ACQUISITION & DEVELOPMENT

Map 19. Proposed recreational access route to Mid-Continent's Cottonwood Creek area



Map 20. Proposed surface facilities for Sheridan Enterprise's Loma project

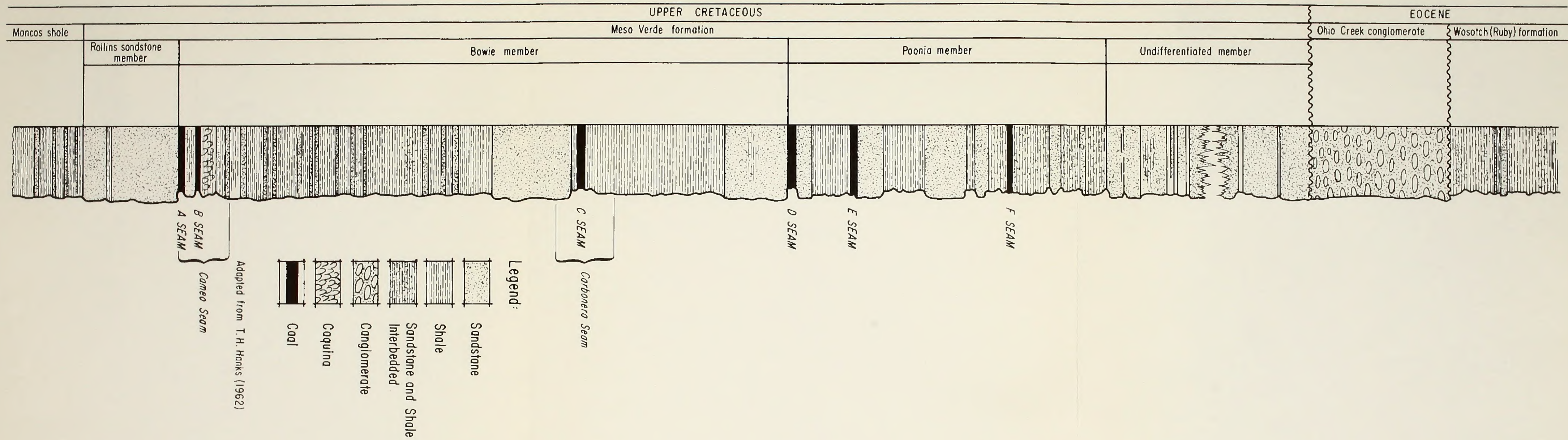


Figure 1. Stratigraphy of coal fields in the ES area

APPENDIX B

TABLE B-1

DOMINANT PLANTS AND CHARACTERISTIC PLANT ASSOCIATIONS OF THE VEGETATION TYPES WITHIN THE REGIONAL ES AREA

Common Name

Scientific Name

Greasewood Type:

Dominant Plant(s)

black greasewood

Sarcobatus vermiculatus

Characteristic Plant Association

alkali sacaton
belvedere summercypus
big sagebrush
fourwing saltbush
foxtail barley
Russian thistle
saltgrass
shadscale

Sporobolous airoides
Kochia scoparia
Artemisia tridentata
Atriplex canescens
Hordeum jubatum
Salsola kali
Distichlis stricta
Atriplex confertifolia

Saltbush Type:

Dominant Plant(s)

Gardner saltbush
mat saltbush
shadscale

Atriplex gardneri
Atriplex corrugata
Atriplex confertifolia

Characteristic Plant Association

blue grama
common winter fat
desert prince's plume
eriogonum
fourwing saltbush
galleta
prickly pear
scarlet coppermallow
wildrye

Bouteloua gracilis
Eurotia lanata
Stanleya pinnata
Eriogonum sp.
Atriplex canescens
Hilaria jamesii
Opuntia sp.
Sphaeralcea coccinea
Elymus sp.

Sagebrush Type:

Dominant Plant(s)

big sagebrush

Artemisia tridentata

Characteristic Plant Association

Desert sagebrush zone

black sagebrush
bottlebrush squirreltail
cheatgrass
hairy goldaster
Indian ricegrass
Russian thistle
silver sagebrush
western wheatgrass

Artemisia nova
Sitanion hystrix
Bromus tectorum
Heterotheca villosa
Oryzopsis hymenoides
Salsola kali
Artemisia cana
Agropyron smithii

Mountain sagebrush zone

American vetch
antelope bitterbrush
Douglas rabbitbrush
mountain snowberry
skyrocket gilia
Thurber's fescue
western yarrow

Vicia americana
Purshia tridentata
Chrysothamnus viscidiflorus
Symphoricarpos oreophilus
Ipomopsis aggregata
Festuca thurberi
Achillea lanulosa

Pinyon-Juniper Type:

Dominant Plant(s)

pinyon pine
Utah juniper

Pinus edulis
Juniperus osteosperma

Characteristic Plant Association

antelope bitterbrush
armored goldenweed
big sagebrush
Douglas rabbitbrush
galleta
Indian ricegrass
junegrass
snakeweed
stemless hymenoxys
western wheatgrass

Purshia tridenta
Haplopappus armeroides
Artemisia tridentata
Chrysothamnus viscidiflorus
Hilaria jamesii
Oryzopsis hymenoides
Koeleria cristata
Gutierrezia sarothae
Hymenoxys acaulis
Agropyron smithii

Mountain Shrub Type:

Dominant Plant(s)

Gambel oak
mountain mahogany
serviceberry

Quercus gambelii
Cercocarpus montanus
Amelanchier utahensis and
Amelanchier alnifolia

Characteristic Plant Association

arrowleaf balsamroot
blue wildrye
chokecherry
elk sedge
hawthorn
junegrass
lambstongue groundsel
mountain snowberry
northern bedstraw
skunkbrush sumac
slender wheatgrass

Balsamorhiza sagittata
Elymus glaucus
Prunus virginiana
Carex geyeri
Crataegus sp.
Koeleria cristata
Senecio integerrimus
Symphoricarpos oreophilus
Galium boreale
Rhus trilobata
Agropyron trachycaulum

Ponderosa Pine - Douglas Fir Type:

Dominant Plant(s)

Douglas fir
ponderosa pine

Pseudotsuga menziesii
Pinus ponderosa

Characteristic Plant Association

Arizona fescue
Fremont geranium
junegrass
mountain muhly
western yarrow

Festuca arizonica
Geranium fremontii
Koeleria cristata
Muhlenbergia montana
Achillea lanulosa

Aspen Type:

Dominant Plant(s)

Aspen

Populus tremuloides

Characteristic Plant Association

alpine timothy
Barbey larkspur
Colorado blue columbine
fringed brome
heartleaf arnica
Kentucky bluegrass
meadowrue

Phleum alpinum
Delphinium barbeyi
Aquilegia caerulea
Bromus anomalus
Arnica cordifolia
Poa pratensis
Thalictrum sp.

Mountain Meadow Type:

Dominant Plants(s)

The mountain meadow type has no dominant plant; it is composed of many species of grasses, sedges and forbs.

Characteristic Plant Association

Dry meadows of the lower mountains

Arizona fescue
Fremont geranium
harebell
Idaho fescue
junegrass
mountain muhly
pine dropseed
western yarrow

Festuca arizonica
Geranium fremontii
Campanula rotundifolia
Festuca idahoensis
Koeleria cristata
Muhlenbergia montana
Blepharoneuron tricholepsis
Achillea lanulosa

Dry meadows of subalpine areas

alpine timothy
cinquefoil
Letterman needlegrass
orange sneezeweed
rough bentgrass
spike trisetum
subalpine needlegrass
Thurber's fescue

Phleum alpinum
Potentilla sp.
Stipa lettermanii
Helenium hoopesii
Agrostis scabra
Trisetum spicatum
Stipa columbiana
Festuca thurberi

Wet meadows

bluejoint reedgrass
buttercups
marsh marigold
Millet woodrush
rushes
sedges
shrubby cinquefoil
tufted hairgrass

Calamagrostis canadensis
Ranunculus sp.
Caltha leptosepala
Luzula parvifolia
Juncus sp.
Carex sp.
Potentilla sp.
Deschampsia caepitosa

Lodgepole Pine Type:

Dominant Plant(s)

Lodgepole pine

Pinus contorta

Characteristic Plant Association

common juniper
elk sedge
grouse whortleberry
heartleaf arnica
russet buffaloberry

Juniperus communis
Carex geyeri
Pachistima myrsinites
Arnica cordifolia
Shepherdia canadensis

Spruce-Fir Type:

Dominant Plant(s)

Engelmann spruce
subalpine fir

Picea engelmannii
Abies lasiocarpa

Characteristic Plant Association

blueberries
gooseberry currant
heartleaf arnica
Jacobs ladder
pseudomycopteris
sickle-top pedicularis
wild strawberries

Vaccinium sp.
Ribes montigenum
Arnica cordifolia
Polemonium delicatum
Pseudomycopteris montanus
Pedicularis racemosa
Fragaria sp.

Alpine Type:

Dominant Plant(s)

The alpine type has no dominant plant; it is composed of many species of grasses, sedges and forbs.

Characteristic Plant Association

alpine avens
alpine bluegrass
alpine fescue
alpine mountain sorrel
alpine mouse-ear
alpine springbeauty
alpine timothy
American bistort
aspen sunflower
Barbey larkspur
chaenactis
Colorado blue columbine
Engelmann spruce (Krummholz)
ligularia
lupine
meadowrue
moss silene

Geum rossii
Poa alpina
Festuca brachyphylla
Oxyria digyna
Cerastium beeringianum
Claytonia megarrhiza
Phleum alpinum
Polygonum bistortoides
Helianthella quinquenervis
Delphinium barbeyi
Chaenactis alpina
Aquilegia caerulea
Picea engelmannii
Ligularia holmii
Lupinus parviflorus
Thalictrum sp.
Silene acaulis

Parry clover
Porter ligusticum
pseudomycopteris
purple pinegrass
rushes
sedges
sibbaldia
slender wheatgrass
spike trisetum
subalpine fir (Krummbolz)
subalpine yarrow
sulfur paintbrush
thickleaf groundsel
thistle

timber oatgrass
tiny hawksbeard
tufted hairgrass

Trifolium parryi
Ligusticum porteri
Pseudomycopteris montanus
Calamagrostis purpurascens
Juncus sp.
Carex sp.
Sibbaldia procumbens
Agropyron trachycaulum
Trisetum spicatum
Abies lasiocarpa
Achillea lanulosa ssp. alpicola
Castilleja septentrionalis
Senecio crassulus
Cirsium scopulorum and
C. hesperium
Danthonia intermedia
Crepis nana
Deschampsia caepitosa

Riparian Type:

Dominant plant(s)

There is no region-wide dominant plant in the riparian type.
In different areas and altitudes the dominants may be saltcedar, cottonwoods, box-elder, birch, willows, aspen, or blue spruce.

Characteristic Plant Association

aspen
birch
box elder
Colorado blue spruce
hawthorn
lanceleaf cottonwood
narrowleaf cottonwood
plains cottonwood
red-osier dogwood
saltcedar
thinleaf alder
willows

Populus tremuloides
Betula sp.
Acer negundo
Picea pungens
Crataegus sp.
Populus acuminata
Populus angustifolia
Populus sargentii
Cornus stolonifera
Tamarix pentandra
Alnus tenuifolia
Salix sp.

Annual Weed Type:

Dominant Plant(s)

The annual weed type has no dominant plant; it consists of many different forbs, and the composition can vary considerably.

Characteristic Plant Association

amaranth

belvedere summercyprus

bindweed

Canada thistle

cocklebur

gumweed

lambsquarters

mullein

ragweed

Russian thistle

sowthistle

tansymustard

tumblemustard

Amaranthus retruflexus and

Amaranthus graecizans

Kochia scoparia

Convolvulus arvensis

Cirsium arvense

Xanthium strumarium

Grindelia sp.

Chenopodium sp.

Verbascum thapsus

Ambrosia sp.

Salsola kali

Sonchus arvensis

Descurainia sp.

Sisymbrium sp.

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APPENDIX C

TABLE 1

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TABLE 1

APPENDIX C

TABLE C-1

TERRESTRIAL WILDLIFE SPECIES KNOWN OR BELIEVED TO INHABIT THE WEST-CENTRAL COLORADO REGION

Legend

1. Native Species

- Yes - Indigenous to the region
- No - Introduced species

2. Residence Status

- R - Resident year long
- M - Migrant, only present during migration periods
- SR - Summer resident (breeding)
- WR - Winter visitor or migrant
- U - Unknown

3. Abundance

- C - Common
- U - Unknown
- O - Occasional
- P - Peripheral
- A - Accidental
- I - Irregular; presence fluctuates from year to year
- E - Endangered (federal or state designation)
- T - Threatened (federal or state designation)

4. Regional Occurrence:

Specific Coal Development Areas Within the Region

- NF - North Fork of the Gunnison River
- BC - Little Bookcliffs (north and east of Grand Junction)
- GH - Grand Hogback
- TC - Thompson Creek

5. Important Habitat Types

2. Intermountain grassland

021 short grass: salt grass, galleta grass

022 mid-grass: bunch grass

025 sod-forming grasses: bluegrass, stream bank wheatgrass,
and western wheatgrass

TABLE C-1

TERRESTRIAL WILDLIFE SPECIES
KNOWN OR BELIEVED TO
INHABIT THE WEST-CENTRAL COLORADO REGION
(continued)

4. Sagebrush
041 Big sagebrush
5. Mountain brush
05A Serviceberry
05B Chokecherry
05C Snowberry
056 Mountain mahogany
058 Oakbrush
059 Other mountain shrubs
6. Coniferous forest
061 Douglas fir
062 Ponderosa pine
064 Spruce-fir
8. Barren
084 Rock
9. Pinyon-juniper woodland
10. Aspen
13. Saltbush
14. Greasewood
18. Annual plants
181 Cheatgrass
185 Annual forbs
19. Cropland
191 Irrigated cropland
192 Dryland crops and pastureland
20. Riparian
201 Deciduous trees (cottonwood, water birch)
202 Bottomland shrubs (willow, tamarisk, alder, coyotebush)
203 Bottomland grasses and forbs
21. Aquatic
212 Fresh meadow (Carex, Juncus)
213 Shallow fresh marsh (cattails, bullrush, spikerush)
214 Deep fresh marsh (pondweed)
215 Open fresh water
23. Habitat alteration area
(Mechanically or chemically treated areas.)

TABLE C-1
TERRESTRIAL WILDLIFE

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Opossum <u>Didelphis virginiana</u>	No	R	P		HT: 20, 191
Masked Shrew <u>Sorex cinereus</u>	Yes	R	P	BC	HT: 202, 212
Wandering Shrew <u>Sorex vagrans</u>	Yes	R		TC, NF	HT: 202 (high altitudes)
Water Shrew <u>Sorex palustris</u>	Yes	R	C	TC, NF	HT: 20, 21 (along streams, above 6,000 ft.)
Merriam's Shrew <u>Sorex merriami</u>	Yes	R	U	BC, NF	HT: 2,4
Little Brown Myotis <u>Myotis lucifugus</u>	Yes	R	C	NF, GH	HT: 6 (forested areas, roost in caves, mines, generally higher elevations, tree hollows, hibernates)
Long Eared Myotis <u>Myotis evotis</u>	Yes	R	U	NF, BC, GH	HT: 4, 5, 6 (middle elevations, roost in trees)
Fringed-tailed Myotis <u>Myotis thysanodes</u>	Yes	R	U	All	HT: 4, 5, 6, 9 (roost in caves, mines, crevices)
Long-Legged Myotis <u>Myotis volans</u>	Yes	SR	U	All	HT: 4, 5, 6, 9, 084 (caves, roost in caves, mines, trees, crevices)
California Myotis <u>Myotis californicus</u>	Yes	R	C	BC	HT: Crevice dweller, lower elevations, hibernates
Small-Footed Myotis <u>Myotis leibii</u>	Yes	R	C	All	HT: Caves in or near forests, hibernates
Silver-Haired Bat <u>Lasionycteris noctivagans</u>	Yes	SR	C	TC, BC, NF	HT: 6, 10, 20
Western Pipistrelle <u>Pipistrellus hesperus</u>	Yes	R	C	NF, BC, TC	HT: 20, 21 (caves, crevices, in arid conditions, near watercourses)
Big Brown Bat <u>Eptesicus fuscus</u>	Yes	R	C	All	HT: Widespread, roost in buildings
Hoary Bat <u>Lasiurus cinereus</u>	Yes	SR	C	All	HT: 6, 9 (roost in trees)
Townsend's Big-eared Bat <u>Plecotus townsendii</u>	Yes	R	C	All	HT: Caves, mine tunnels, hibernates, widespread below 9,000 ft.
Pallid Bat <u>Antrozous pauidus</u>	Yes	R	U	BC, GH	HT: Semi-arid canyonlands, hibernates, roost in caves, crevices, and trees
Brazilian Free-tailed Bat <u>Tadarida brasiliensis</u>	Yes	M	P		HT: Caves and buildings
Big Free-tailed Bat <u>Tadarida macrotis</u>	Yes	M	P		HT: Caves and crevices

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Pika <u>Ochotone princeps</u>	Yes	R	U		HT: 084 (talus slopes)
Nuttall's Cottontail <u>Sylvilagus nuttallii</u>	Yes	R	C	GH, NF, TC	HT: 6 (brushy edge of woodland, generally above 6,000 ft.), 20
Desert Cottontail <u>Sylvilagus audubonii</u>	Yes	R	C	BC, NF	HT: 2, 4, 5, 9 (xeric band, generally below 6,500 ft.)
Snowshoe Hare <u>Lepus americanus</u>	Yes	R	C	TC, NF	HT: 6, 10 (above 8,000 ft.)
White-tailed Jackrabbit <u>Lepus townsendii</u>	Yes	R	C	NF, GH	HT: 2, 4, 13, 14, 18
Black-tailed Jackrabbit <u>Lepus californicus</u>	Yes	R	P	BC	HT: 2, 4 (up to 7,000 feet)
Least Chipmunk <u>Eutamias minimus</u>	Yes	R	C	A11	HT: Wide geo-ecological range
Colorado Chipmunk <u>Eutamias quadrivittatus</u>	Yes	R	C	A11	HT: 6, 084, 9
Uinta Chipmunk <u>Eutamias umbrinus</u>	Yes	R	U	GH, TC	HT: 062, 084 (possibly only north of the Colorado River), 9
Yellow-Bellied Marmot <u>Marmota flaviventris</u>	Yes	R	C	A11	HT: 084, 191 (talus slopes)
White-tailed Antelope Squirrel <u>Ammospermophilus leucurus</u>	Yes	R	C	BC, GH, NF	HT: 2, 4, 5, 9
Richardson's Ground Squirrel <u>Spermophilus richardsonii</u>	Yes	R	C		HT: 2, 4
Thirteen Lined Ground Squirrel <u>Spermophilus tridecemlineatus</u>	Yes	R	P	TC	HT: 2 (grasslands, plains)
Rock Squirrel <u>Spermophilus variegatus</u>	Yes	R	C	A11	HT: 084, 4, 9
Golden-mantled Ground Squirrel <u>Spermophilus lateralis</u>	Yes	R	C	A11	HT: 6, 9, 10 (open forest edges, above 5,000 ft.)

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Black-tailed Prairie Dog <u>Cynomys ludovicianus</u>	Yes	R	C	A11	HT: 2, 4, 5
White-tailed Prairie Dog <u>Cynomys leucurus</u>	Yes	R	C	BC	HT: 2, 4, 5 (xeric sites)
Gunnison's Prairie Dog <u>Cynomys gunnisoni</u>	Yes	R	C	NF	HT: 4, 13 (mountain parks and valleys, in unit a lower dryer sites)
Red Squirrel (Chickaree) <u>Tamiasciurus hudsonicus</u>	Yes	R	C	NF, TC	HT: 6 (mixed hardwood forests, pine, spruce)
Albert's Squirrel <u>Sciurus alberti</u>	Yes	R	P		HT: 062
Botta's Pocket Gopher <u>Thomomys bottae</u>	Yes	R	U		HT: Valleys, meadows, 203, Sandy soils
Northern Pocket Gopher <u>Thomomys talpoides</u>	Yes	R	C	NF, TC	HT: 2, 4, 5, 6 (open forest)
Apache Pocket Mouse <u>Perognathus apache</u>	Yes	R	U	BC	HT: 4, 5, 9, 12 (arid valleys)
Ord's Kangaroo Rat <u>Dipodomys ordii</u>	Yes	R	U	BC, GH, NF	HT: Sandy soils, arid areas
Beaver <u>Castor canadensis</u>	Yes	R	C	A11	HT: 20, 21 (streams with abundant vege- tation)
Western Harvest Mouse <u>Reithrodontomys megalotis</u>	Yes	R	C	BC, GH, NF	HT: 2, 4, 5, 18 (dense vegetation, lower elevations)
Canyon Mouse <u>Peromyscus crinitus</u>	Yes	R	C	BC, NF, GH	HT: 084 (canyons, arid)
Deer Mouse <u>Peromyscus maniculatus</u>	Yes	R	C	A11	HT: Widespread
Brush Mouse <u>Peromyscus boylii</u>	Yes	R	C	NF	HT: 4, 5, 9 (not found north of the Colo- rado River, semi-arid rocky areas)
Pinon Mouse <u>Peromyscus truei</u>	Yes	R	C	BC, GH, NF	HT: 9
Northern Grasshopper Mouse <u>Onychomys leucogaster</u>	Yes	R	C	BC	HT: 2, 4, 5, 084 (semi-arid, lower elevations)

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
White-throated Woodrat <u>Neotoma abigula</u>	Yes	R	U	BC, GH	HT: 084 (rocky areas, <u>Opuntia</u> spp. are important food and cover)
Mexican Woodrat <u>Neotoma mexicana</u>	Yes	R	C	BC, NF, GH	HT: 056, 058, 9
Bushy-tailed Woodrat <u>Neotoma cinerea</u>	Yes	R	C		HT: 2, 4, 5, 6, 9 (abandoned buildings, rocky areas)
Desert Woodrat <u>Neotoma lepida</u>	Yes	R	P	BC	HT: 4, 13, west of Grand Junction
Southern Red- backed Vole <u>Ciethrionomys</u> <u>gapperi</u>	Yes	R	P	TC	HT: 6 (lodge pole pine)
Heather Vole <u>Phenacomys</u> <u>intermedius</u>	Yes	R	C		HT: 6, 8, 20
Meadow Vole <u>Microtus</u> <u>pennsylvanicus</u>	Yes	R	P?	NF	HT: 212, 213 (bogs)
Montane Vole <u>Microtus montanus</u>	Yes	R	U?	TC, NF	HT: 212 (above 6,000 ft. on moist meadows)
Long-tailed Vole <u>Microtus longicaudus</u>	Yes	R	C	BC, NF, TC	HT: 212 preferred, also 4 and 6
Sagebrush Vole <u>Lagurus curtatus</u>	Yes	R	U	A11	HT: 041 (<u>Artemisia</u> limited)
Muskrat <u>Ondatra zibethicus</u>	Yes	R	C	A11	HT: 213, 214, 215
House Mouse <u>Mus musculus</u>	No	R	C	A11	HT: Urban areas, buildings
Western Jumping Mouse <u>Zapus princeps</u>	Yes	R	C	TC, NF	HT: 202 (willow), 10 (aspen) above 6,000 feet near streams
Porcupine <u>Erethizon dorsatum</u>	Yes	R	C	A11	HT: 062, 9, 20
Coyote <u>Canis latrans</u>	Yes	R	C	A11	HT: Montane environments (widespread)
Grey Wolf <u>Canis lupus</u>	Yes	R	Extirpated		HT: Montane
Red Fox <u>Vulpes vulpes</u>	Yes	R	C	A11	HT: Montane 6, 19, 212, 20

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Kit Fox <u>Vulpes macrotis</u>	Yes	R	R	BC	HT: 4, 13, 14
Gray Fox <u>Urocyon</u> <u>cinereoargenteus</u>	Yes	R	U	All	HT: 5, 6, 9
Ringtail <u>Bassariscus astutus</u>	Yes	R	C	BC, GH, NF	HT: 4, 9, 084 (rough, broken terrain, lower elevations)
Raccoon <u>Procyon lotor</u>	Yes	R	C	All	HT: 19, 20
Black Bear <u>Ursus americanus</u>	Yes	R	C	All	HT: Montane 5, 6, 10
Grizzly Bear <u>Ursus arctos</u>	Yes	R	Extirpated		HT: 5, 6
Black-footed Ferret <u>Mustela nigripes</u>	Yes		E	NF	HT: 4, 13, 14 (Prairie dog towns)
Marten <u>Martes americana</u>	Yes	R	UC	NF, TC	HT: Spruce-fir and lodgepole pine (dense)
Ermine, short-tailed <u>Mustela erminea</u>	Yes	R	U	All	HT: 6, 10
Long-tailed Weasel <u>Mustela crenata</u>	Yes	R	C	All	HT: 2, 4, 5, 6, 10 (on woodlands and plains)
Mink <u>Mustela vison</u>	Yes	R	U	NF, TC, BC	HT: 6, 20, 10
Wolverine <u>Gulo gulo luscus</u>	Yes	R	E	TC	HT: 6 (wilderness species)
Badger <u>Texidea taxus</u>	Yes	R	C	All	HT: 2, 4, 5, 9 (open areas)
Spotted Skunk <u>Spilogale putorius</u>	Yes	R	U	All	HT: 4, 9, 19, 20 (below 8,000 ft.)
Striped Skunk <u>Mephitis mephitis</u>	Yes	R	C	All	HT: 2, 4, 5, 9, 19, 20 (dense around cropland)
Mountain Lion <u>Felis concolor</u>	Yes	R	C	All	HT: 084, 9, 20, 4, 5, 6 (rough broken terrain)
River Otter <u>Lutra canadensis</u>	Yes	R	E	NF	HT: 20, 21 (originally in Colorado and Gunnison rivers; re-introduced into the Gunnison River in 1976)
Bobcat <u>Felis rufus</u>	Yes	R	C	All	HT: 4, 5, 6, 9, 084 (foothills and canyons)
Lynx <u>Felis lynx</u>	Yes	R	E	TC, NF	HT: 6

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
American Elk <u>Cervus elaphus</u>	Yes	R	C	TC, NF	HT: 4, 6, 9, 10, 19, 20 (parks, meadows, alpine tundra, and open forests)
Mule Deer <u>Odocoileus hemionus</u>	Yes	R	C	All	HT: All types
Pronghorn Antelope <u>Antilocapra americana</u>	Yes	R	C	BC	HT: 2, 4, 8, 13
Bighorn Sheep <u>Ovis canadensis</u>	Yes	R	UC		HT: 2, 5, 6, 084 (restricted to high, rugged mountains)
Wild Horse <u>Equus</u>	No	R	C	BC	HT: 4, 5, 9 Little Bookcliffs Wild Horse Area
Common Loon <u>Gavia immer</u>	Yes	M	P		HT: 21
Western Grebe <u>Acchmophorus occidentalis</u>	Yes	M	C		HT: 21
Red-necked Grebe <u>Podiceps grisegena</u>	Yes	M	P		HT: 21
Horned Grebe <u>Podiceps auritus</u>	Yes	M	P		HT: 21
Eared Grebe <u>Podiceps caspicus</u>	Yes	M	C		HT: 21
Pied-billed Grebe <u>Podilymbus podiceps</u>	Yes	R	C		HT: 21
Double-crested Cormorant <u>Phalacrocorax auritus</u>	Yes	M	P		HT: 21
Great Blue Heron <u>Ardea herodias</u>	Yes	SR	C	BC, NF	HT: 21, Colonial nester
Little Blue Heron <u>Florida cacrulea</u>	Yes	M	P		HT: 21
Green Heron <u>Butorides viresens</u>	Yes	M	P		HT: 21
Black-crowned Night Heron <u>Nycticorax nycticorax</u>	Yes	M-SR	P		HT: 21
Common Egret <u>Casmerodius albus</u>	Yes	M	P		HT: 21
Snowy Egret <u>Leucophyox thula</u>	Yes	M-SR	C		HT: 21

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
American Bittern <u><i>Botaurus lentiginosus</i></u>	Yes	M	P		HT: 213, 214
Eastern Least Bittern <u><i>Ixobrychus exilis</i></u>	Yes	M	P		HT: 213, 214
White-faced Ibis <u><i>Plegadis chihi</i></u>	Yes	M	U		HT: 21
Whistling Swan <u><i>Olar columbianus</i></u>	Yes	M	P		HT: 21
Ross' Goose <u><i>Chen rossii</i></u>	Yes	M	P		HT: 21
Snow Goose/Blue Goose <u><i>Chen hyperborca</i></u>	Yes	M	P		HT: 21
White-fronted Goose <u><i>Anser albifrons</i></u>	Yes	M	P		HT: 21
Canada Goose <u><i>Branta canadensis</i></u>	No	R-M	C	BC	HT: 21
Black Brant <u><i>Branta nigricans</i></u>	Yes	M	P		HT: 21
Mallard <u><i>Anas platyrhynchos</i></u>	Yes	R	C	NF, BC, TC	HT: 21
Gadwall <u><i>Anas strepera</i></u>	Yes	R	C		HT: 21
American Widgeon <u><i>Mareca americana</i></u>	Yes	M	C		HT: 21
American Green-winged Teal <u><i>Anas carolinensis</i></u>	Yes	M-SR	C		HT: 21
Blue-winged Teal <u><i>Anas discors</i></u>	Yes	SR	C		HT: 21
Cinnamon Teal <u><i>Anas cyanoptera</i></u>	Yes	SR	C	BC	HT: 21
Northern Shoveler/ Shoveler <u><i>Spatula clypeata</i></u>	Yes	M	C		HT: 21
Pintail <u><i>Anas acuta</i></u>	Yes	M-SR	C		HT: 21
Wood Duck <u><i>Aix sponsa</i></u>	Yes	M	U		HT: 21
Redhead <u><i>Aythya americana</i></u>	Yes	UR	C		HT: 21

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Canvasback <u>Aythya valisineria</u>	Yes	M	U		HT: 21
Lesser Scaup <u>Aythya affinis</u>	Yes	M	C		HT: 21
Ring-necked Duck <u>Aythya collaris</u>	Yes	M	U		HT: 21
Common Goldeneye <u>Bucephala clangula</u>	Yes	W	C	BC, NF	HT: 21
Barrow's Goldeneye <u>Bucephala islandica</u>	Yes	W	U		HT: 21
Buffalohead <u>Bucyphala albeola</u>	Yes	W	U		HT: 21
Oldsquaw <u>Clangula hyemalis</u>	Yes	M	U		HT: 21
Common Scoter <u>Oidemia nigra</u>	Yes	M	U		HT: 21
White-winged Scoter <u>Melanitta deglandi</u>	Yes	M	U		HT: 21
Ruddy Duck <u>Oxyura jamaicensis</u>	Yes	SR	C		HT: 21
Common Merganser <u>Mergus merganser</u>	Yes	W	C	BC, NF	HT: 21
Red-breasted Merganser <u>Mergus serrator</u>	Yes	W	U	BC, NF	HT: 21
Hooded Merganser <u>Lophodytes cucullatus</u>	Yes	M	P	NF, BC	HT: 21
Turkey Vulture <u>Cathartes aura</u>	Yes	SR	C	A11	HT: Rugged country, 2, 4, 5, 6, 9, 20
Marsh Hawk or Harrier <u>Circus cyaneus</u>	Yes	R	C	BC, NF, GH	HT: 2, 13, 18, 19, 20, 4
Sharp-shinned Hawk <u>Accipiter striatus</u>	Yes	R M	U C	A11	HT: 058, 6, 9, 10
Cooper's Hawk <u>Accipiter cooperi</u>	Yes	R	U	A11	HT: 058, 6, 9
Goshawk <u>Accipiter gentilis</u>	Yes	R	U	TC, NF	HT: 6, 20, 10
Red-tailed Hawk <u>Buteo jamaicensis</u>	Yes	R	C	A11	HT: A11 types, widespread

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Swainson's Hawk <u>Buteo swainsoni</u>	Yes	SR-M	UC	A11	HT: 2, 19
Rough-legged Hawk <u>Buteo lagopus</u>	Yes	WR	C	BC, NF, GH	HT: 2, 19
Berruginous Hawk <u>Buteo regalis</u>	Yes	SR	UC	BC, NF, GH	HT: 2, 6, 19, 20
Golden Eagle <u>Aquila chrysaetos</u>	Yes	R	C	A11	HT: 2, 6, 19, 20, wide range, primarily a cliff nester
Bald Eagle <u>Haliaeetus</u> <u>leucoccephalus</u>	Yes	W	C	BC, NF, GH	HT: 20, along major streams
Prairie Falcon <u>Falco mexicanus</u>	Yes	R	UC	BC, GH, NF	HT: 2, 4, 5, 084, cliff nester
Peregrine Falcon <u>Falco peregrinus</u>	Yes	SR	E	BC	HT: Wide range, 084, cliff nester, 20
Merlin/Pigeon Hawk <u>Falco columbarius</u>	Yes	M	P	A11	HT: 2
American Kestrel/ Sparrow Hawk <u>Falco sparverius</u>	Yes	R	C	A11	HT: 2 (plains and mountain valleys) 4, 5, 6, 9, 084, 10, 20
Osprey <u>Pandion haliaetus</u>	Yes	M	U	BC	HT: Rivers, lakes, coast
White-tailed Ptarmigan <u>Lagopus leucurus</u>	No	R	UC		HT: Alpine, 8
Blue Grouse <u>Dendragapus obscurus</u>	Yes	R	C	TC, NF	HT: 6
Sharp-tailed Grouse <u>Pedioecetes</u> <u>phasianellus</u>	Yes	R	P		HT: 2, 4, 5
Sage Grouse <u>Centrocercus</u> <u>urophasianus</u>	Yes	R	U		HT: 2,4
Mountain Quail <u>Oreortyx pictus</u>	Yes	R	U		HT: 5, 6, transplanted near Gateway
Gambel's Quail <u>Lophortyx gambelli</u>	Yes	R	C	BC	HT: 4, 5, 19, 20
Ring-necked Pheasant <u>Phasianus colchicus</u>	No	R	C	NF, BC	HT: 19, 20
Chukar Partridge/ Chukar <u>Alectoris graeca</u>	No	R	C	BC, GH, NF	HT: 2 (plains) 4, 084

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Merriam's Turkey <u>Meleagris gallopauo</u>	Yes	R	C	TC, NF	HT: 5, 6, 10
Sandhill Crane <u>Grus canadensis</u>	Yes	M	P		HT: 2, 19, 21
Whooping Crane <u>Grus americana</u>	Yes	E	P	NF	HT: 19
Virginia Rail <u>Rallus limicolo</u>	Yes	M	P		HT: 213
Sora <u>Porzana carolina</u>	Yes	M	P		HT: 213
American Coot <u>Fulica americana</u>	Yes	M	C		HT: 213, 214
Black-bellied Plover <u>Squatarola squatarola</u>	Yes	M	U		HT: 212, 213
American Golden Plover <u>Pluvialis dominica</u>	Yes	M	U		HT: 21
Killdeer <u>Charadrius vociferus</u>	Yes	R	C	NF, TC, BC	HT: 19, 21
Semipalmated Plover <u>Charadrius semipalmatus</u>	Yes	M	U		HT: 21
Mountain Plover <u>Eupoda montana</u>	Yes	M	C		HT: 21 (semi-arid)
Common Snipe <u>Capella gallinago</u>	Yes	SR-M	C	BC, NF	HT: 19, 212, 213, 20
Pectoral Sandpiper <u>Erolia melanotos</u>	Yes	M	U		HT: 19, 212, 213
Baird's Sandpiper <u>Erolia bairdii</u>	Yes	M	C		HT: 21
Least Sandpiper <u>Erolia minutilla</u>	Yes	M	C		HT: 21
Semipalmated Sandpiper <u>Ereunetes pusillus</u>	Yes	M	P		HT: 215
Western Sandpiper <u>Ereunetes mauri</u>	Yes	M	C		HT: 214, 215
Solitary Sandpiper <u>Tringa solitaria</u>	Yes	M	C		HT: 20, 21

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Buff-breasted Sandpiper <u>Tryngites</u> <u>subruficollis</u>	Yes	M	U		HT: 2, 19
Spotted Sandpiper <u>Actitis macularia</u>	Yes	SR	C	BC, NF	HT: 215
Long-billed Curlew <u>Numenius americanus</u>	Yes	M	U		HT: 19, 21
Willet <u>Catoptrophorus</u> <u>semipalmatus</u>	Yes	M	U		HT: 21
Greater Yellowlegs <u>Totanus melanolcucus</u>	Yes	M	C		HT: 215
Lesser Yellowlegs <u>Totanus flavipes</u>	Yes	M	U		HT: 215
Knot <u>Calidris canutus</u>	Yes	M	U		HT: 21
Long-billed Dowitcher <u>Limnodromus</u> <u>scolopaceus</u>	Yes	M	C		HT: 214, 215
Marbled Godwit <u>Limosa fedoa</u>	Yes	M	P		HT: 214, 215
Sanderling <u>Crocethia alba</u>	Yes	M	U		HT: 215
American Avocet <u>Recurvirostra</u> <u>americana</u>	Yes	M	C		HT: 215
Black-necked Stilt <u>Himantopus mexicanus</u>	Yes	M	U		HT: 215
Northern Phalarope <u>Lobipes lobatus</u>	Yes	M	C		HT: 19
Wilson's Phalarope <u>Steganopus tricolor</u>	Yes	M	C		HT: 214, 215
Pomarine Jaeger <u>Stereovarius</u> <u>pomarinus</u>	Yes	M	U		HT: 20, 21
Herring Gull <u>Larus argentatus</u>	Yes	M	C		HT: 19, 215
California Gull <u>Larus californicus</u>	Yes	SR	P		HT: 19, 215
Ring-billed Gull <u>Larus delawarensis</u>	Yes	M	C		HT: 19, 215 (Prairies)

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Franklin's Gull <u>Larus pipixcan</u>	Yes	M	C		HT: 19, 215 (prairies)
Bonaparte's Gull <u>Larus philadelphia</u>	Yes	M	C		HT: 215 (muskeg)
Forster's Tern <u>Sterna forsteri</u>	Yes	SR-M	P		HT: 213, 214, 215
Common Tern <u>Sterna hirando</u>	Yes	M	U		HT: 215
Least Tern <u>Sterna albifrons</u>	Yes	M	U		HT: 215
Black Tern <u>Chlidonias niger</u>	Yes	M	P		HT: 215
Band-tailed Pigeon <u>Columba fasciata</u>	Yes	SR	C	TC, NF	HT: 5, 10
Rock Dove/Domestic Pigeon <u>Columba livia</u>	Yes	R	C	BC, NF	HT: 19, 084
Mourning Dove <u>Zenaidura macroura</u>	Yes	SR	C	A11	HT: 2, 4, 5, 7, 9, 10, 13, 14, 18, 19 20, 21, 23
Yellow-billed Cuckoo <u>Coccyzus americanus</u>	Yes	SR	U		HT: 10, 20
Barn Owl <u>Tyto alba</u>	Yes	SR	U	A11	HT: 2, 10, 19, 20, Nest on cliffs or old buildings
Long-eared Owl <u>Asio otus</u>	Yes	R	C	A11	HT: 6, 9, 19, 20
Short-eared Owl <u>Asio flammeus</u>	Yes	R	U	BC, NF	HT: 19, 2 nests on ground
Saw-whet Owl <u>Aegolius acadicus</u>	Yes	R	U	A11	HT: 6, 10, 20, cavity nester
Screech Owl <u>Otus asio</u>	Yes	R	U	A11	HT: 10, 19, 20, cavity nester
Great Horned Owl <u>Bubo virginianus</u>	Yes	R	C	A11	HT: 10, 20, 4, 9, 6
Burrowing Owl <u>Speotyto cunicularia</u>	Yes	SR	C	BC	HT: 2, 4, prairie dog towns
Pygmy Owl <u>Glaucidium gnoma</u>	Yes	R	U	A11	HT: 6, 10, cavity nester
Poor-will <u>Phalaenoptilus nuttallii</u>	Yes	SR	C	A11	HT: Plains and lower mountains

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Common Nighthawk <u>Chordeiles minor</u>	Yes	SR	C	All	HT: Plains to mountains
Black Swift <u>Cypseloides niger</u>	Yes	SR	P	TC, NF	HT: Open sky, mountain country, cavity nester in cliffs, 10
White-throated Swift <u>Gerrhonotus saxatilis</u>	Yes	SR	C	BC, NF	HT: Open sky, dry mountains, canyons
Rivoli's Hummingbird <u>Eugenes fulgeas</u>	Yes	M	P		HT: 6, 9, 10
Black-chinned Hummingbird <u>Archilochus alexandri</u>	Yes	SR	C	All	HT: 4, 5, 19, 20
Broad-tailed Hummingbird <u>Selasphorus pyrrhuloxia</u>	Yes	SR	C	All	HT: 10, 19, 20, 5
Rufous Hummingbird <u>Selasphorus rufus</u>	Yes	M	C	TC, NF	HT: 6, 10, 19, 20
Calliope Hummingbird <u>Stellula calliope</u>	Yes	SR	C	NF	HT: 6, 10
Belted Kingfisher <u>Megascops alcyon</u>	Yes	R	C	NF, BC	HT: 20, 21
Lewis Woodpecker <u>Asyndesmus lewis</u>	Yes	R	U	BC	HT: 20, cavity nester, large cottonwoods
Hairy Woodpecker <u>Dendrocopos villosus</u>	Yes	R	C	All	HT: 6, 10, 20
Downy Woodpecker <u>Dendrocopos pubescens</u>	Yes	R	C	All	HT: 6, 10, 20 cavity nester
Northern Three-toed Woodpecker <u>Picoides tridactylus</u>	Yes	R	U	TC	HT: 6, cavity nester
Yellow-bellied Sapsucker <u>Sphyrapicus varius</u>	Yes	SR	P	TC, NF	HT: 10, 6
Williamson's Sapsucker <u>Sphyrapicus thyroideus</u>	Yes	M	P		HT: 6 (Ponderosa pine)
Red Shafted Flicker <u>Colaptes cafer</u>	Yes	R	C	All	HT: 9, 19, 20, 6 Cavity nester
Yellow Shafted Flicker <u>Colaptes auratus</u>	Yes	M	U	BC	HT: 19, 20 Cavity nester

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Eastern Kingbird <u>Tyrannus tyrannus</u>	Yes	M	P	BC, NF	HT: 19, 20
Western Kingbird <u>Tyrannus verticalis</u>	Yes	SR	C	A11	HT: 19, 20
Cassin's Kingbird <u>Tyrannus vociferans</u>	Yes	SR	U	A11	HT: 5, 6, 9, 10, 20
Ash-throated Flycatcher <u>Myiarchus</u> <u>cinerascens</u>	Yes	SR	C	A11	HT: 2, 4, 5, 9 (pinyon-juniper), cavity nester
Olivaceous Flycatcher <u>Myiarchus</u> <u>tuberculifer</u>	No	M	U	A11	HT: 058, 6, 9
Say's Phoebe <u>Sayornis saya</u>	Yes	SR	C	A11	HT: 2, 4, 5, 192
Western Flycatcher <u>Empidonax difficilis</u>	Yes	SR	C	A11	HT: 6, 10, 19, 20
Traill's Flycatcher <u>Empidonax traillii</u>	Yes	SR	U	BC, NF	HT: 20, 202
Hammond's Flycatcher <u>Empidonax hammondi</u>	Yes	SR	U	BC, GH, NF	HT: 6
Dusky Flycatcher <u>Empidonax oberholseri</u>	Yes	M	U	A11	HT: 058, 10, 202 (high altitudes)
Gray Flycatcher <u>Empidonax wrightii</u>	Yes	SR	C	A11	HT: 4, 9
Western Wood Pewee <u>Contopus sordidulus</u>	Yes	SR	C		HT: 5, 6, 9
Horned Lark <u>Eremophila alpestris</u>	Yes	R	C	BC, NF, GH	HT: 2, 4, 7 (open country)
Purple Martin <u>Progne subis</u>	Yes	SR	U	TC	HT: 6, 10, 19, 20, cavity nester
Cliff Swallow <u>Petrochelidon</u> <u>pyrrhonota</u>	Yes	SR	C	A11	HT: 19, 20 (cliffs and bridges) mud nests
Barn Swallow <u>Hirundo rustica</u>	Yes	SR	C	A11	HT: 19, 20, 21
Tree Swallow <u>Iridoprocne bicolor</u>	Yes	SR	C	A11	HT: 20, 21 cavity nesters
Violet-green Swallow <u>Tachycineta</u> <u>thalassina</u>	Yes	SR	C	A11	HT: 062 (cliffs) mud nests

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Bank Swallow <u>Riparia riparia</u>	Yes	SR	C	NF, BC, GH	HT: 21 (waterways) nests in bank
Rough-winged Swallow <u>Stelgidopteryx</u> <u>raficollis</u>	Yes	SR	C	BC, NF, GH	HT: 21 (near waterways)
Steller's Jay <u>Cyanocitta stelleri</u>	Yes	R	C	A11	HT: 5, 6
Scrub Jay <u>Apelocoma</u> <u>coerulescens</u>	Yes	R	C	GH, NF	HT: 058, 9
Gray Jay <u>Perosoreus</u> <u>canadensis</u>	Yes	R	C	TC, NF	HT: 6 generally above 4,000 feet
Black-billed Magpie <u>Pica pica</u>	Yes	R	C	A11	HT: (open country)
Common Raven <u>Corvus corax</u>	Yes	R	C	A11	HT: Common throughout
Common Crow <u>Corvus brachyrhynchos</u>	Yes	R-M	P	A11	HT: 19, 20, 21
Clark's Nutcracker <u>Nucifraga columbiana</u>	Yes	R	P	TC, NF	HT: 6, 10 often near timberline
Pinyon Jay <u>Gymnorhinus</u> <u>cyanocephalus</u>	Yes	R	C	A11	HT: 9, loose colonial nester
Plain Titmouse <u>Parus inornatus</u>	Yes	R	P	BC, GH, NF	HT: 9, 058, 4, 20
Black-capped Chickadee <u>Parus atricapillus</u>	Yes	R	UC	BC, GH, NF	HT: 062, 9, 10
Mountain Chickadee <u>Parus gambeli</u>	Yes	R	C	A11	HT: 6, 4
Bushtit <u>Psaltiriparus minimus</u>	Yes	R	P	BC, GH, NF	HT: 4, 5, 9
White-breasted Nuthatch <u>Sitta carolinensis</u>	Yes	R	P	TC, NF	HT: 6, 10
Red-breasted Nuthatch <u>Sitta canadensis</u>	Yes	R	P	A11	HT: 10, 9
Pygmy Nuthatch <u>Sitta pygmaea</u>	Yes	R	P	TC, NF	HT: 062
Brown Creeper <u>Certhia familiaris</u>	Yes	R	C	TC, NF	HT: 6, 10

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Dipper (Water Ouzel) <u>Cinclus mexicanus</u>	Yes	R	C	BC, NF, TC	HT: 41 (high waterways)
Rock Wren <u>Salpinctes obsoletus</u>	Yes	SR	C	BC, GH, NF	HT: Plains and low valleys, rocky areas, 4, 9
Canyon Wren <u>Catherpes mexicanus</u>	Yes	SR	P	BC, GH, NF	HT: (Dry canyons)(Below 8,000 feet)
Bewick's Wren <u>Thryomanes bewickii</u>	Yes	R	C	BC, GH, NF	HT: 9, 4, 20
House Wren <u>Troglodytes aedon</u>	Yes	SR	C	A11	HT: Widespread
Winter Wren <u>Troglodytes</u> <u>Troglodytes</u>	Yes	WR	U	NF, TC	HT: 5, 6
Long-billed Marsh Wren <u>Telmatodytes</u> <u>palustris</u>	Yes	R	U		HT: (Marshes), 21
Mockingbird <u>Mimus polyglotos</u>	Yes	SR	U	BC, NF	HT: 4, 5
Gray Catbird/Catbird <u>Dumetella</u> <u>carolinensis</u>	Yes	M	C	BC, NF	HT: 5, 20
Sage Thrasher <u>Oreoscoptes montanus</u>	Yes	SR	P	BC, GH, NF	HT: 4, 5
Robin <u>Turdus migratorius</u>	Yes	R	C	A11	HT: 6, 10, 20
Swainson's Thrush <u>Hylocichla ustulata</u>	Yes	M	C	NF, BC	HT: 6, 10, 20
Hermit Thrush <u>Hylocichla guttata</u>	Yes	SR	P		HT: 6, 10
Veery <u>Hylocichla</u> <u>fuscescens</u>	Yes	M	P	NF, BC	HT: 20
Western Bluebird <u>Sialia mexicana</u>	Yes	SR	U	TC, NF	HT: 10, cavity nester
Mountain Bluebird <u>Sialia currucoides</u>	Yes	SR	C	A11	HT: 6, 10, 4, 9, cavity nester
Townsend's Solitaire <u>Myadestes townsendi</u>	Yes	R	C	A11	HT: 6, 10, winter 4, 9
Blue-gray Gnatcatcher <u>Polioptila caerulea</u>	Yes	SR	C	A11	HT: 4, 9, 20

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native Species ¹	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Golden-crowned Kinglet <u>Regulus satrapa</u>	Yes	SR	U	TC, NF	HT: 064
Ruby-crowned Kinglet <u>Regulus calendula</u>	Yes	M	C	TC, NF	HT: 6
Water Pipit <u>Anthus spinoletta</u>	Yes	M	U		HT: 20 (winters), tundra, alpine zone in summer.
Bohemian Waxwing <u>Bombycilla garrula</u>	Yes	M	P		HT: Boreal forest, muskeg
Cedar Waxwing <u>Bombycilla cedrorum</u>	Yes	R	U	A11	HT: Plains and mountains, 20
Northern Shrike <u>Lanius excubitor</u>	Yes	WR	C	BC, NF, GH	HT: Semi-open or open country, 1, 4, 5, 13, 14
Loggerhead Shrike <u>Lanius ludovicianus</u>	Yes	R	C	BC, GH, NF	HT: Open country 1, 13, 14
Starling <u>Sturnas vulgaris</u>	No	R	C	A11	HT: Towns and ranches
Warbling Vireo <u>Vireo gilvus</u>	Yes	WR	C	BC, NF	HT: 10, 20, 5, 9
Solitary Vireo <u>Vireo solitarius</u>	Yes	SR	C	A11	HT: 058, 10, 6, 9
Gray Vireo <u>Vireo vicinior</u>	Yes	SR	P	A11	HT: 5, 9
Black-and-white Warbler <u>Miniotilta varia</u>	Yes	M	P	BC, TC, NF	HT: Woodlands 10, 20
Virginia's Warbler <u>Vermivora virginia</u>	Yes	SR	C	TC, NF	HT: 058 (Foothills)
Orange-crowned Warbler <u>Vermivora celata</u>	Yes	SR	C	TC, NF, BC	HT: 5 (moist brush) 9, 10, 20
Tennessee Warbler <u>Vermivora peregrina</u>	Yes	M	U	A11	HT: 4, 5, 9
Yellow Warbler <u>Dendroica petechia</u>	Yes	SR	C	NF, BC	HT: 202
Myrtle Warbler <u>Dendroica coronata</u>	Yes	M	U	TC, NF	HT: 6, 10
Audubon's Warbler <u>Dendroica auduboni</u>	Yes	SR	C	BC, TC, NF	HT: 6, 10, 20
Graces's Warbler <u>Dendroica graciae</u>	Yes	SR	U	TC, NF	HT: 058, 062

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Black-throated Gray Warbler <u>Dendroica nigrescens</u>	Yes	SR	C	BC, GH, NF	HT: 9 (P-J) 13, 14
Townsend's Warbler <u>Dendroica townsendi</u>	Yes	M	C	TC, NF	HT: 6
MacGillivray's Warbler <u>Operornis tolmici</u>	Yes	SR	C	BC, NF	HT: 202
Yellowthroat <u>Geothlypis trichas</u>	Yes	SR	C	BC, NF	HT: 20
Yellow-breasted Chat <u>Icteria virens</u>	Yes	SR	C	BC, NF	HT: 20
Wilson's Warbler <u>Wilsonia pusilla</u>	Yes	SR	C	BC, NF	HT: 20
American Redstart <u>Setophaga ruticilla</u>	Yes	M	U	TC, NF	HT: 10, 20 (second growth)
Painted Redstart <u>Setophaga picta</u>	Yes	M	P	BC	HT: 058, 7 (canyons)
House Sparrow <u>Passer domesticus</u>	No	R	C	All	HT: Common resident of towns and ranches
Bobolink <u>Dolichonyx oryzivorus</u>	Yes	SR	U	BC, TC	HT: 2, 20, 19
Western Meadowlark <u>Sturnella neglecta</u>	Yes	R	C	BC, NF, GH	HT: 2, 19
Yellow-headed Blackbird <u>Xanthocephalus xanthocephalus</u>	Yes	SR	C	BC, NF	HT: 213
Red-winged Blackbird <u>Agelaius phoeniceus</u>	Yes	R	C	All	HT: 213, 19
Bullock's Oriole <u>Icterus bullockii</u>	Yes	SR	C	BC, NF	HT: 10, 20 (towns also)
Brewer's Blackbird <u>Euphagus eyan- ocuphalus</u>	Yes	R	C	All	HT: Towns and ranches, 20, 21
Common Grackle <u>Quiscalus quiscula</u>	Yes	SR	C	BC, NF	HT: 19, 20 (towns)
Brown-headed Cowbird <u>Molothrus ater</u>	Yes	SR	C	All	HT: 19, 20
Western Tanager <u>Piranga ludoviciana</u>	Yes	SR	C	TC, BC, NF	HT: 10, 20

TABLE C-1
 TERRESTRIAL WILDLIFE
 (continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Evening Grosbeak <u>Hesperiphana vespertina</u>	Yes	R	U	TC, NF	HT: 6
Pine Grosbeak <u>Pinicola enucleator</u>	Yes	R	P	TC, NF	HT: 064
Black-headed Grosbeak <u>Pheucticus melanocephalus</u>	Yes	SR	C	All	HT: 10, 20, 5, 6
Blue Grosbeak <u>Guiraca caerulea</u>	Yes	SR	U	BC, NF	HT: 202 (near fields)
Lazuli Bunting <u>Passerina amoena</u>	Yes	SR	C	BC, NF	HT: 4, 5, 10, 13, 14
Cassin's Finch <u>Carpodacus cassinii</u>	Yes	R	C	NF, TC	HT: 6 (high mountains), 10
House Finch <u>Carpodacus mexicanus</u>	Yes	R	C	All	HT: Towns and ranches (varied)
Gray-crowned Rosy Finch <u>Leucosticte tephrocotis</u>	Yes	SR	C		HT: High country, isolated, 8
Black Rosy Finch <u>Leucosticte atrata</u>	Yes	SR	C		HT: Higher altitudes, isolated, 6, 8
Brown-capped Rosy Finch <u>Leucosticte australis</u>	Yes	WR	P	NF	HT: 084 (above timberline summer) low-lands winter 5, 9
American Goldfinch <u>Spinus tristis</u>	Yes	R	C	BC, TC, NF	HT: 058, 062, 19, 20
Lesser Goldfinch <u>Spinus psaltria</u>	Yes	SR	P	NF, TC	HT: 058, 062, 4, 20
Pine Siskin <u>Spinus pinas</u>	Yes	R	C	TC, NF	HT: 6, 10, 19, 20
Red Crossbill <u>Loxia curvirostra</u>	Yes	R	P	TC, NF	HT: 062
Rufous-sided Towhee <u>Pipilo erythrophthalmus</u>	Yes	SR	C	NF, BC	HT: 5, 058 (scrub oak) 20
Green-tailed Towhee <u>Chlorura chlorura</u>	Yes		C	BC, NF, GH	HT: 056, 058, 4
Lark Bunting <u>Calamospiza melanocorys</u>	Yes	SR	C	BC	HT: 2, (mountain parks) 13, 14, 19

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Vesper Sparrow <u>Poocetes gramineus</u>	Yes	SR	C	BC, NF	HT: 2, 4, 5, 19
Savannah Sparrow <u>Passerculus sandwichensis</u>	Yes	SR	P	BC	HT: 2, 19, 212 (salty)
Grasshopper Sparrow <u>Ammodramus savannarum</u>	Yes	SR	U	BC, NF	HT: 2, 19 ungrazed areas
Lark Sparrow <u>Chondestes grammacus</u>	Yes	SR	C	BC, NF	HT: 4, 5, 19, 20, 13, 14
Harris' Sparrow <u>Zonotrichia querula</u>	Yes	M	U	TC	HT: 5, 10 (boreal forest summers)
White-crowned Sparrow <u>Zonotrichia leucophrys</u>	Yes	SR-M	C	NF, TC, BC	HT: 5, 10 (summer) 20 (towns) winter
White-throated Sparrow <u>Zonotrichia albicollis</u>	Yes	WR	U	BC, NF	HT: 5, 19, 20 (undergrowth)
Tree Sparrow <u>Spizella arborea</u>	Yes	WR	U	BC, GH, NF	HT: 4, 5, 202 (weeds)
Whipping Sparrow <u>Spizella passerina</u>	Yes	SR	C	BC, GH, NF	HT: 202, 9
Brewer's Sparrow <u>Spizella breweri</u>	Yes	SR	C	BC	HT: 4, 13, 17
Gray-headed Junco <u>Junco caniceps</u>	Yes	R	C	TC, NF	HT: 6, 10
Black-throated Sparrow <u>Amphispiza bilineata</u>	Yes	SR	U	BC	HT: 4, 13, 14
Sage Sparrow <u>Amphispiza belli</u>	Yes	SR	P	BC, NF	HT: 4, 13, 14
Rufous-crowned Sparrow <u>Aimphila ruficeps</u>	Yes	SR	P	BC, NF, GH	HT: Dry rocky canyons
Song Sparrow <u>Melospiza melodia</u>	Yes	R	C	BC, NF	HT: 20
Lincoln's Sparrow <u>Melospiza lincolni</u>	Yes	M	C	NF	HT: 202 (mountain valleys) 212
Swamp Sparrow <u>Melospiza georgiana</u>	Yes	M	U		HT: Brushy muskeg, marshes

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Fox Sparrow <u>Passerella iliaca</u>	Yes	M	U		HT: 202 (at high altitudes) 20
Lapland Longspur <u>Calcarius lapponicus</u>	Yes	SR	C	BC, NF	HT: 19 (weedy fields) 4, 13, 14
Oregon Junco <u>Junco oreganus</u>	Yes	WR	U	BC, NF	HT: 4, 5, 20
Slate-colored Junco <u>Junco hyemalis</u>	Yes	WR	U	BC, NF, TC	HT: 6, 19, 20
White Winged Junco <u>Junco aikenii</u>	Yes	WR	C		HT: 6 (open pine forests)
Tiger Salamander <u>Ambystoma tigrinum</u>	Yes	R	C	A11	HT: 213, 214
Western Spadefoot Toad <u>Scaphiopus hammondi</u>	Yes	R	C	BC, NF, GH	HT: 2, 4, 19, 20, 21
Great Basin Spade- foot Toad <u>Scaphiopus</u> <u>intermontanus</u>	Yes	R	C	A11	HT: 21, 19, 20
Western Toad <u>Bufo boreas</u>	Yes	R	C	A11	HT: 21, 20, 10, 19
Great Plains Toad <u>Bufo cognatus</u>	Yes	R	C	A11	HT: 041
Woodhouse Toad <u>Bufo woodhousei</u>	Yes	R	C	BC, NF, GH	HT: 2, 19, 20, 21
Red Spotted Toad <u>Bufo punctatus</u>	Yes	R	O		HT: 2, 4, 054, 19, 20, 21
Boreal Chorus Frog <u>Pseudacris</u> <u>triscriata</u>	Yes	U	U	NF, BC, TC	HT: 191, 213, 20, 21
Canyon Tree Frog <u>Hyla arenicolor</u>	Yes	R	P	NF	HT: 21, 084, 20
Leopard Frog <u>Rana pipiens</u>	Yes	R	C	BC, NF, TC	HT: 21, 19, 20
Bullfrog, Jumbo <u>Rana catesbeiana</u>	No	R	C	BC	HT: 19, 213, 214
Western Yellow- bellied Racer <u>Coluber constrictor</u>	Yes	R	C	BC, GH, NF	HT: 023, 5, 6, 9, 201
Striped Desert Whip Snake <u>Masticophis</u> <u>taeniatus</u>	Yes	R	P		HT: 023, 4, 5, 062

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Corn Snake or Rat <u>Elaphe guttata</u>	Yes	R	C		HT: 6, 20
Great Basin Gopher Snake <u>Pituophis</u> <u>melanotus</u>	Yes	R	C	All	HT: 2, 4, 5, 6, 19, 20
Utah Milk Snake <u>Lampropeltis</u> <u>triangulum</u>	Yes	R	P	NF	HT: 022, 6
Water Snake <u>Natrix sipedon</u>	Yes	R	C		HT: 2, 4, 5, 6, 7
Western Terrestrial Garter Snake (wan- dering) <u>Thamaphis elegans</u>	Yes	R	C	BC, NF, TC	HT: 2, 4, 5, 6, 9, 201
Utah Black-headed Snake <u>Tantilla planiceps</u> <u>uthensis</u>	Yes	R	P		HT: 2, 4, 058, 9
Mesa Verde Night Snake <u>Hypsiglena torquata</u> <u>torquata</u>	Yes	R	P		HT: 2, 4, 5, 084
Prairie Rattlesnake <u>Crotalus viridis</u>	Yes	R	C	BC, NF	HT: 022, 4, 5, 6, 9, 10, 19, 20
Midget Faded Rattle- Snake <u>Crotalus viridis</u> <u>concolor</u>	Yes	R	UC	BC	HT: 022, 5, 6, 10, 021
Western Smooth Green Snake <u>Opheodrys</u> <u>melanoleucus</u>	Yes	R	C	NF, GH	HT: 2, 20
Yellow-headed Collared Lizard <u>Crotaphytus collaris</u> <u>auriceps</u>	Yes	R	C	BC, NF	HT: 084, 021, 4, 13
Leopard Lizard <u>Gambelia wislizenii</u>	Yes	R	C	BC, GH	HT: 021, 4, 13, 14
Northern Plateau Lizard <u>Sceloporus undulatus</u>	Yes	R	C	BC, NF, GH	HT: 2, 4, 084, 9
Northern Sagebrush Lizard <u>Sceloporus</u> <u>graciosus</u>	Yes	R	U	BC, GH, NF	HT: 4, 5, 6, 9, 202

TABLE C-1
TERRESTRIAL WILDLIFE
(continued)

Species Common and Scientific Names	Native ¹ Species	Residence ² Status	Abundance ³	Regional ⁴ Occurrence	Important Habitat Types ⁵
					List Major Habitat Type, Subtype No. Specific Distribution-Specific Habitat Requirements, Major Geographical Locations
Northern Side- blotched Lizard <u>Uta stansburiana</u>	Yes	R	C	BC, GH, NF	HT: 2, 4, 5, 20
Northern Tree Lizard <u>Urosaurus ornatus</u>	Yes	R	C	NF, BC	HT: 5, 084, 9, 20
Shorthorned Lizard <u>Phrynosoma douglassi</u>	Yes	R	C	BC, GH, NF	HT: 4, 5, 6, 9
Desert Horned Lizard <u>Phrynosoma platyrhinas</u>	Yes	R	C	NF, BC, GH	HT: 2, 4, 084, 9
Western Skink <u>Eumeces skiltonianus</u>	Yes	R	D	BC, GH, NF	HT: 2, 4, 5, 6, 7
Plateau Whiptail <u>Cnemidophorus velox</u>	Yes	R	C	BC, GH, NF	HT: 5, 9, 201
Northern Whiptail <u>Cnemidophorus tigris</u>	Yes	R	C	BC, GH, NF	HT: 2, 4, 5, 6, 9
Common Snapping Turtle <u>Chelydra serpentina</u>	Yes	R	P		HT: 213, Grand Valley
Western Box Turtle <u>Terapene ornata</u>	Yes	R	O		HT: 022, 023, 5, 20 Grand Valley
Painted Turtle <u>Chrysemys picta</u>	Yes	R	I		HT: 21

APPENDIX D

APPENDIX D

ARCHEOLOGICAL METHODOLOGY

Procedures Used to Identify Archeological Sites

The identification of cultural resources within the regional ES area was accomplished through the following:

1. Comprehensive literature search of published and unpublished of archeological research in the area
2. Search of the Office of the State Archaeologist's site files (as as contact with Montrose and Grand Junction districts, BLM; the U.S. Forest Service; and the National Park Service)
3. Review of the National Register of Historic Places
4. Statistical sample inventory of the area by Archaeological Inc., for the purpose of developing a predictive probability model of distribution.

Results of Literature Search and Site File Search

Prior to the implementation of the ES study, a variety of research had been carried out within the bounds of the ES area. Much of the work was done during the 1930s and 1940s by amateur, semi-professional, and professional archeologists (see Huscher 1939, Huscher and Huscher 1940, Huscher and Huscher 1943, Schroeder 1953, Wormington and Lister 1956, Hurst 1957, Schroeder 1964, Peterson 1970).

Review of the accumulated data was begun by Wormington and Lister (1956) and culminated in the definition of the Uncompahgre Complex (see regional chapter 2). This work was expanded by Buckles (1971). Since that time, professional archeologists have been working in the area in conjunction with various governmental agencies. The result of recent inventories has been further substantiation of the previous works that defined the aboriginal use of the area (see Lister and Sandburg 1963, Smith 1966, Jennings 1968, Buckles 1968, Ambler 1969, Breternitz 1973, Breternitz et al. 1974, Carpenter and Stiger 1975, and Breternitz and Breternitz 1975, Williams 1975, Breternitz and Williams 1976).

Archaeological Associates Sampling Design

Prior to implementing the ES, a contract was let to Archaeological Associates, Inc., of Boulder, Colorado, for the purpose of performing an inventory of selected tracts in the ES area. The purpose of the inventory was to statistically sample approximately 28,390 acres of land in the Grand Junction and Montrose districts in order to develop a predictive model of site location that would aid future planning efforts so that potential major mitigation of archeological and historical sites could be avoided.

The research design is a stratified sample of various environmental zones located in the ES area. The zones were delineated using Soil Conservation Service criteria. The percent of each zone type in the ES area was plotted, and a ratio percent of that zone was chosen for inventory. All sites found in the transect zones were recorded and random samples of 30 artifacts were collected on each site. Temporally diagnostic material was also collected but not included in the statistical random sample from each site.

Upon completion of the stratified inventory, the material will be used in an attempt to develop a predictive model of site location. The final draft of the report is due December 15, 1978. Copies of the results of the inventory and the predictive model will be on file with Interagency Archaeological Services, National Park Service, Denver, Colorado, and each Bureau of Land Management District Office.

Preliminary Results of West-Central Coal Lease Survey

Archaeological Associates has inventoried 49 percent of the 28,390 acres to undergo archeological inventory and has identified 51 sites and 97 isolated artifacts. While the development of a predictability model awaits the completion of the survey, some general observations have been noted in the preliminary report concerning site location (Hibbets 1978).

Sites occur in greater frequency within the pinyon-juniper vegetation zone. All base camps were located within this zone, suggesting more in-

tensive use and greater exploitation of resources available in pinyon-juniper zones.

Correlations between location of campsites and (1) upland, (2) canyon, and (3) streamside environments have been noted. The position of base camps within or near these three natural resource zones provides a wider range of food, which would allow for more prolonged use.

Lithic scatters have been noted to occur on canyon-rim. These elevated positions provide panoramic views necessary to observe game movements.

Isolated artifacts, as they are divided into chipped stone and ground stone, appear to be correlated with elevation. Tool types reflect human activity, and the presence of one type over the other serves to indicate the response of the users to the surrounding environment. Chipped stone or ground stone tools can be correlated to ecozone changes within the various elevation ranges.

The survey results indicate an archaic-type subsistence pattern. Land use, as it relates to food procurement, can be correlated to vegetation type,

altitude, and topography. These different variables combine to form distinct environmental zones. The final analysis of the survey results should reveal the relationship between the various ecozones, their defining characteristics, and site distribution, as well as provide the basis for interpreting cultural responses as adaptations to subsistence needs within each zone. With a valid regional model, we should be able to predict the probability of archeological sites occurring within specific environmental zones.

APPENDIX E

TABLE E-1
RECORDED HISTORIC SITES IN ES AREA

Site Number	Site Name	Physical Feature(s)	Size (Acres)	Ownership a/	Condition b/	Appears to Qualify for National Register?	Significance c/			
							N	S	L	County
GRAP-001	Ranch Railbed Fisher Creek School Aspen & Western Railroad	4 buildings	5	PVT	Fair	No			X	Garfield
GRAP-002		Rail line	1	BLM	Poor	No			X	Garfield
GRAP-003		School	1	PVT	Good	Yes			X	Garfield
GRAP-004		Railbed	1.5 mile	PVT	Fair	Yes			X	Pitkin
GRAP-005	Union Mine Ovens	Coke Ovens	5	PVT/BLM (adjacent)	Ruins	Yes			X	Pitkin
GRAP-006	South Branch Cemetary	Cemetary	5	PVT	Poor	No			X	Pitkin
GRAP-007	Ranch	2 buildings	2	PVT	Ruins	No			X	Pitkin
GRAP-008	Crystal River and San Juan Railroad	Railbed	0.5 mile x 20 feet	BLM/USFS	Poor	Yes			X	Pitkin
GRAP-009	Redstone, Colorado	Townsite	10	PVT	Good	Yes		X		Pitkin
GRAP-010	Cleveholm Mansion	Building	5	PVT	Good	Yes		X		Pitkin
GRAP-011	Marble, Colorado	Townsite	10	PVT	Good/Fair	Yes		X		Gunnison
GRAP-011a	Ranch	2 buildings	2	PVT	Fair	No			X	Pitkin
GRAP-012	Cabin	Cabin	1	PVT	Fair/Poor	No			X	Pitkin
GRAP-013	Ranch	3 buildings	3	PVT/BLM	Fair	Yes			X	Garfield
GRAP-014	South Canyon Mine	Mine	20	PVT/BLM	Ruins	No			X	Garfield
GRAP-015	Mine	Foundation	1	PVT	Ruins	No			X	Garfield
GRAP-016	South Canyon Bridge	Bridge	0.5 mile	BLM	Good	Yes			X	Garfield
GRAP-017	Colorado Midland Railroad	Railbed		PVT/USFS	Fair/Poor	Yes		X		Pitkin
GRAP-018	Sellar Ovens	Coke Ovens	2	PVT/USFS	Fair/Poor	Yes			X	Pitkin
GRAP-019	Thomasville Smelter	Oven	1	PVT/USFS	Fair	Yes			X	Pitkin
GRAP-020	Independence, Colorado	Townsite	25	USFS	Poor	Yes		X		Pitkin
GRAP-021	Ashcroft, Colorado	Townsite	10	USFS	Fair/Good	Yes		X		Pitkin
GRAP-022	House	Building	1	PVT	Fair/Poor	No			X	Garfield
GRAP-023	Bridge at Silt, Colorado	Bridge	0.5	PVT	Good	Yes			X	Garfield
GRAP-024	Garfield Creek School	School	1	PVT	Fair	Yes			X	Garfield
GRAP-025	Beiddi Creek School	School	1	PVT/BLM	Fair	No			X	Garfield
GRAP-026	Alkali Creek School	School	1	PVT/BLM	Fair	Yes			X	Garfield
GRAP-027	Cabin	Log cabin	1	PVT	Poor	No			X	Garfield
GRAP-028	Shacks	2 shacks	1	PVT	Fair	No			X	Garfield
GRAP-029	Ranch	4 buildings	5	PVT/BLM	Fair	Yes			X	Garfield
GRAP-030	Ranch	3 buildings	2	PVT/BLM	Fair	No			X	Garfield
GRAP-031	Divide Creek Cemetary	Cemetary	10	PVT/BLM	Good	No			X	Garfield
GRAP-032	Cabin	Stucco cabin	1	PVT/BLM	Fair	No			X	Garfield
GRAP-033	Cabins	2 buildings	1	PVT	Poor	No			X	Garfield
GRAP-034	Mamm Creek School	School	1	PVT	Fair	Yes			X	Garfield

TABLE E-1

RECORDED HISTORIC SITES IN ES AREA
(continued)

Site Number	Site Name	Physical Feature(s)	Size (Acres)	Ownership a/	Condition b/	Appears to Qualify for National Register?	Significance c/			County
							N	S	L	
GRAP-035	Cabin	Log cabin	1	PVT	Poor	No			X	Garfield
GRAP-036	Homestead	Log cabins	1	PVT	Fair/Poor	Yes			X	Garfield
GRAP-037	Homestead	Dugout	1	PVT	Poor	No			X	Garfield
GRAP-038	Canyon Creek School	School	1	PVT	Fair	Yes			X	Garfield
GRAP-039	Barn	4 loft barn	1	PVT	Poor	No			X	Garfield
GRAP-040	Barn	Log barn	1	PVT/BLM	Fair	No			X	Garfield
GRAP-041	West Divide Creek Church	Church	1	PVT	Fair	Yes			X	Garfield
GRAP-042	Cabin	Frame cabin	1	PVT	Fair	No			X	Garfield
GRAP-043	Foundation	Foundation	1	PVT	Ruins	No			X	Garfield
GRAP-044	Cabin	Log cabin	1	PVT	Poor/Ruins	No			X	Rio Blanco
GRAP-045	Cabin	Log cabin	1	PVT	Fair	No			X	Rio Blanco
GRAP-046	Ranch	Log house	1	PVT	Poor/Fair	No			X	Rio Blanco
GRAP-047	Ranch	Frame house	1	CO	Fair	No			X	Garfield
GRAP-048	Mine	Coal mine	2	PVT	Fair	Yes			X	Garfield
GRAP-049	Taughenbaugh Mesa School	School	1	PVT	Fair	No			X	Garfield
GRAP-050	Foundation	Foundation	1	PVT	Ruins	No			X	Garfield
GRAP-051	House	Log house	1	PVT	Fair	No			X	Garfield
GRAP-052	Una, Colorado School	School	1	PVT	Fair	No			X	Garfield
GRAP-053	Una Bridge	Bridge	1	PVT	Fair	No			X	Garfield
GRAP-054	Battlement Mesa Cemetery	Cemetery	10	PVT	Good	No			X	Garfield
GRAP-055	Battlement Mesa School	School	1	PVT	Fair	Yes			X	Garfield
GRAP-056	Ranch	Wood house	2	PVT	Fair	No			X	Garfield
GRAP-057	Ranch	Rock house	1	PVT	Poor/Fair	Yes			X	Garfield
GRAP-058	Cabin	Log cabin	1	PVT	Poor	No			X	Garfield
GRAP-059	Ranch	Log house	2	PVT	Fair	Yes			X	Garfield
GRAP-060	Ranch	Log cabins	1	PVT	Poor/Ruins	No			X	Garfield
GRAP-061	Cabin	Log garage	1	PVT	Poor	No			X	Garfield
GRAP-062	Foundation	Foundation	1	PVT	Ruins	No			X	Garfield
GRAP-063	House	Frame house	1	PVT	Poor	No			X	Garfield
GRAP-064	Rifle, Colorado Bridge	Bridge	1	PVT	Fair	No			X	Garfield
GRAP-065	House	Log house	1	PVT	Fair/Poor	No			X	Garfield
GRAP-066	Cabin	Log cabin	1	PVT	Ruins	No			X	Garfield
GRAP-067	Ranch	5 buildings	3	PVT	Fair	Yes			X	Garfield
GRAP-068	Ranch	Frame house	2	PVT	Fair	No			X	Garfield
GRAP-069	Stage Station at Rifle, Colorado	Frame building	1	PVT	Fair	Yes			X	Garfield

TABLE E-1
RECORDED HISTORIC SITES IN ES AREA
(continued)

Site Number	Site Name	Physical Feature(s)	Size (Acres)	Ownership a/	Condition b/	Appears to Qualify for National Register?	Significance c/			County
							N	S	L	
GRAP-070	Foundation	Foundation	1	PVT	Ruins	No			X	Garfield
GRAP-071	Grand Valley Bridge	Bridge	1	PVT	Good/Fair	Yes			X	Garfield
GRAP-072	Cactus Valley School	School	1	PVT	Fair	Yes			X	Garfield
GRAP-073	New Castle Colorado Cemetery	Cemetery	15	PVT	Fair	No			X	Garfield
GRAP-074	Cardiff, Colorado Ovens	Coke Ovens	0.04 mile x 40 feet	PVT	Fair/Poor	Yes			X	Garfield
GG-001	Gypsum Mine	Mine	10	PVT	Fair	No			X	Montrose
GG-002	Uranium Mine	Mine	10	BLM	Fair/Poor	No			X	Montrose
GG-003	Mine Adit	Adit	1	BLM	Fair	No			X	Montrose
GG-004	Ute Trail	Trail	1	BLM	Fair	Yes			X	Montrose
GG-005	Howell's Village	Townsite	5	BLM	Fair	Undetermined			X	Montrose
GG-006	Ute Trail Cabin	Cabin	0.05	BLM	Poor	Undetermined			X	Montrose
GG-007	Lime Kiln	Kiln	5	PVT/BLM (adjacent)	Fair	Yes			X	Montrose
GG-008	Duncan Cabin	Cabin	1	BLM	Poor	No			X	Montrose
GG-009	Cabin/Forge	Cabin	1	BLM	Poor	No			X	Montrose
GG-010	Foundation	Foundation	1	BLM	Poor	No			X	Montrose
GG-011	Red Canyon Cabin	Cabin	1	BLM	Fair	No			X	Montrose
GG-012	Cabin	Cabin	1	BLM	Poor	No			X	Montrose
GG-013	Cabin	Cabin	1	BLM	Poor	No		X	X	Delta
UG-001	D&RGW Rail Line	Railbed	1	BLM	Poor	No		X		
UG-002	Cedar Hill Cemetery	Cemetery	10	BLM/PVT (adjacent)	Good	No			X	Ouray
UG-003	Shin Park Foundation	Foundation	1	BLM	Ruins	No			X	Montrose
UG-004	Canal	Canal	9.8	BLM/PVT	Poor	No			X	Montrose
UG-005	Dumpsite	Dump	1	BLM	Poor	No			X	Montrose
UG-006	D&RGW Railgrade	Railbed	12.2	BLM/PVT	Poor	Yes			X	Montrose/ Gunnison
UG-007	Potato Shed	Shed	1	PVT/BLM (adjacent)	Good	No			X	Montrose
UG-008	Cabin	Cabin	1	PVT/BLM (adjacent)	Good	No			X	
UG-009	Homestead (Olathe)	Cabin	1	PVT/BLM (adjacent)	Good	No			X	Montrose
UG-010	Selig Canal	Canal	2	BLM	Poor	No			X	Montrose
UG-011	Cabin	Cabin	1	PVT/BLM (adjacent)	Fair	No			X	Montrose
UG-012	Grave	Gravesite	0.05	BLM	Poor	No			X	Montrose
UG-013	Domiguez Bridge	Bridge	0.05	BLM	Good	No			X	Delta

TABLE E-1

RECORDED HISTORIC SITES IN ES AREA.
(continued)

Site Number	Site Name	Physical Feature(s)	Size (Acres)	Ownership a/	Condition b/	Appears to Qualify for National Register?	Significance c/			County
							N	S	L	
UG-014	D&RGW Rail Line	Railbed	26.84	BLM/PVT	Good	Undetermined	X		X	Delta
UG-015	Escalante Cabin	Cabin	1	PVT/BLM (adjacent)	Fair	No			X	Delta
UG-016	Captain Smith House	Cabin	2	CO/BLM (adjacent)	Good	Undetermined			X	Delta
UG-017	Cabin	Cabin	1	PVT/BLM (adjacent)	Fair	No			X	Delta
UG-018	Homestead	Homestead	5	PVT/BLM (adjacent)	Fair	No			X	
UG-019	Foundation	Foundation	0.75	PVT/BLM (adjacent)	Ruins	No			X	
UG-020	Barn	Barn	2	BR/BLM (adjacent)	Poor	No			X	Delta
UG-021	Hansen Mansion	Home	5	PVT	Good	Yes			X	Delta
UG-022	Building	Building	2	PVT/BLM (adjacent)	Fair	No			X	Delta
UG-023	Delta Pumphouse	Pumphouse	2	BLM	Good	No			X	Delta
UG-024	Mill	Millsite	5	PVT/BLM (adjacent)	Ruins	No			X	Ouray
SM-001a	Bridge at Uravan	Bridge	1	BLM	Good	No			X	Montrose
SM-002	Homestead	Debris	1	BLM	Ruins	No			X	Montrose
SM-003	Bedrock, Colorado Townsite	Store	1	PVT/BLM (adjacent)	Fair	Yes			X	Montrose
SM-004	Opera Box Minesite	Mine	1	BLM/AEC	Fair	No			X	Montrose
SM-012	Mine (un-named)	Mine	1	BLM	Fair	Yes			X	Montrose
SM-013	Dugout	Mine	1	BLM/claim	Fair	Yes			X	Montrose
SM-025	Whitney Mines	Mines	5	BLM/claim	Fair	No			X	Montrose
SM-026	Coke Oven	Oven	1	BLM	Good	Yes			X	Montrose
SM-027	Cabin	Cabin	1	BLM	Good	No			X	Montrose
SM-033	Redvale School	School	1	PVT	Fair	No			X	Montrose
SM-034	Coventry, Colorado Townsite	Town	5	PVT	Fair/Poor	Yes			X	Montrose

a/ BLM = Bureau of Land Management; PVT = private; CO = State of Colorado; BR = Bureau of Reclamation; USFS = U.S. Forest Service.

b/ "Condition" refers to the present physical condition of a historical site--the condition of the structure(s) or area of the site (including any evidence of vandalism), the condition of architecture, and the condition of the land around the site. A site in "good" condition would have a building with excellent structural quality, the land around it would be nearly like the original, and there would be no signs of vandalism. A site in "poor" condition would show signs of decay, the land might be modified, and there might be signs of human or animal intrusion.

c/ N = national; S = state; L = local.

APPENDIX F

VISUAL RESOURCE MANAGEMENT

The visual resources of the public lands that are managed by the Bureau of Land Management are controlled by a three phase process: (1) visual resource inventory and evaluation, (2) visual resource contrast rating, and (3) visual resource project planning and design. The objective is to provide a systematic approach for identifying scenic quality and setting minimum quality standards for management of the visual resource values by a process which classifies public lands into one of five visual resource management (VRM) classes.

Visual Resource Inventory and Evaluation

The identification of scenery units is the first step in the inventory phase. Landscapes are organized by defining areas which have similar scenery and landscape attributes. These landscape scenery units are evaluated and categorized according to seven criteria: landform, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modifications. Gradations within each criterion (see table 1) are represented by numerical values; the sum of the numerical values for all seven criteria would identify the subject landscape as outstanding, characteristic, or common, and would establish the landscape's visual character. The general impression that one receives from a view would be the visual character of a landscape and would be the prime image of that view that one would remember.

The second step in the inventory phase is to assign a 'sensitivity' rating to an area. The high, medium, or low rating would represent the public sensitivity or projected reaction to various levels of change in the landscape's character. User volume--both vehicular and pedestrian --and expressed user attitudes are the bases for the sensitivity rating. The identification of key observation points and of foreground, midground, and background zones establishes a hierarchy of viewing points and scene areas. By combining the scene area analysis, key observation points, corridors, and areas, and user attitudes, land areas are rated for their visual importance to the public and for sensitivity to change in those land areas.

The third step in the visual resource inventory and evaluation phase is to analyze the scenic quality map and the sensitivity map in order to allocate

the landscapes to visual resource management classes. These five classes outline the degrees of modification allowed in the basic elements of the landscape; form, line, color, and texture of land and water bodies, vegetation, and structures would also be the basic elements to establish landscape character. The VRM classes are the basis for establishing VRM planning objectives for resource lands and the limits for accommodating future cultural alterations.

Class I

I This class provides primarily for natural ecological changes; management activities are to be restricted and are not to attract attention.

Class II

Changes in the basic elements caused by management activities should not be evident in the characteristic landscape.

Class III

Contrasts to the basic elements may be evident and begin to attract attention, but they should remain subordinate to the existing characteristic landscape.

Class IV

Alterations may attract attention but should repeat the form, line, color, and texture elements of the characteristic landscape.

Class V

Rehabilitation is needed to restore the landscape to the character of the surrounding landscape.

Visual Resource Contrast Rating

The degree to which a management activity adversely impacts the visual quality of a landscape depends on the extent of visual contrast that is created between the activity and the existing landscape character. Contrast is measured by separating the landscape into land and water surfaces, vegetation, and structures, and then predicting the magnitude of change in contrast with the basic elements (form, line, color, and texture for each of the three major features). Assessment of the degree of contrast will indicate the severity of impact and would guide the determinations for reducing the contrasts

to meet the requirements of the VRM classes. Contrasts are considered from the most critical viewpoints for distance, angle of observation, length of time, relative size of the project, season of the year, light, and the effects of time on the healing process. (Table F-2 summarizes VRM contrast ratings for the site-specific actions.)

Visual Resource Project Planning and Design

The identification of specific contrasts in form, line, color, and texture indicate the problems which could allow design mitigation. By applying design procedures to proposed actions, visual contrasts can be eliminated or reduced to potentially meet the visual planning objectives that are stipulated in the VRM class designations. Once a project has been designed to reduce visual contrasts, it is reassessed by the visual contrast system to determine if the project can meet the area's visual goals and, if not, to what degree the landscape's visual resource would be impacted.

TABLE F-1
SCENIC QUALITY
INVENTORY AND EVALUATION CHART

Key Factors		Rating Criteria and Score	
Landform	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.	Steep canyons, mesas, buttes, cinder cones and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features present and interesting though not dominant or exceptional.	Low, rolling hills, foothills or flat valley bottoms. Interesting detail landscape features few or lacking.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still, cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent or present, but not noticeable.
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water, or snow fields,	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.	Subtle color variations, contrast or interest; generally mute tones.
Influence of Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
Cultural Modifications	Free from aesthetically undesirable or discordant sights and influences; or modifications add favorably to visual variety.	Scenic quality is somewhat depreciated by inharmonious intrusions, but not so extensive that the scenic qualities are entirely negated or modifications add little or no visual variety to the area.	Modifications are so extensive that scenic qualities are for the most part nullified or substantially reduced.

TABLE F-2

VRM CONTRAST RATINGS FOR SITE-SPECIFIC ACTIONS

	VRM Class II		VRM Class III		VRM Class IV		VRM Class V	
	Element	Feature	Element	Feature	Element	Feature	Element	Feature
Maximum Points	2	10	2	16	-	20	-	Number of points based on VRM Class Potential
Mid-Continent Coal Canyon	12	29	-	-	-	-	-	-
Cottonwood	-	-	-	-	8	16	-	-
Sheridan East Salt Creek	12	22	-	-	-	-	-	-
Spink	-	-	-	-	12	21	-	-
Munger	-	-	-	-	12	32	-	-
McClane	-	-	-	-	8	15	-	-
"Refuse"	-	-	-	-	8	23	-	-
Anschutz	-	-	8	16	-	-	8	16
ARCO	12	25	-	-	-	-	12	25
General Exploration	-	-	-	-	-	-	4	7

APPENDIX G

SOCIOECONOMIC METHODOLOGIES

The Colorado Population and Employment Model (CPEIO) was used to generate the county-level population projections used in the ES for all counties with the exception of Pitkin. Population projections developed by the Pitkin County Planning Department were used in that county. The CPEIO model was originally developed by the University of Colorado, Graduate School of Business Administration. It is currently used by the Colorado State Division of Planning to forecast trends in population growth or decline throughout Colorado. The following excerpt from 'An Introduction to Socio-Economic Model Building and the Colorado Population and Employment Model,' by David Monarchi and Robert Taylor, August 1977, discusses the model and its components.

CPEIO is a simulation model which attempts to mimic the overall demographic and economic forces operating in a specific study area (SA). The model is written in a general format so that it can be configured to represent any study area.

CPEIO concentrates upon providing a causal framework for net employment migration by calculating it internally in relation to the available labor force, the unemployment rate, the proportion of the labor force employed at more than one job, the net proportion of out-commuting, and total employment. The model incorporates births, deaths and four types of net migration: retirement, military, college and employment. It produces population projections by age and sex, and employment projections for up to 25 industry groups.

A fundamental assumption in the CPEIO model is that employment levels are at least partly determined by population levels. An increase in population triggers an increase in employment which may lead to an increase in population due to migration, and so on.

CPEIO consists of two interlinked submodels: (1) a population submodel which calculates births and deaths, and (2) an employment submodel which generates net employment-related migration. These two submodels are joined together to connect the demographic forces of births and deaths and the economic impact of job opportunities upon employment migration. The interrelationship reflects the impact of population changes upon the economy; and, conversely, the migration due to employment opportunities adds to the population which must be served.

The Population Submodel

The population submodel is divided into three parts. The first component calculates births and deaths by applying age-specific fertility and age and sex specific survival rates to the resident population. The second component consists of net retirement, military and college migration estimates input to the model. The totals are disaggregated into age-sex cohorts through the use of relative frequency distribution--one each for retirement, military and college. These two are essentially the familiar cohort-survival technique except that employment-related migration is determined separately. The third is a 'dependent' component composed of net employment-related migration which is based on changes calculated in the employment submodel. (Births and

deaths are calculated for the migrant as well as the resident subpopulations, assuming the same survival and fertility rates.)

The submodel begins with a base year population (or population at previous forecast period) broken down into one-year age groups. To this population is added the retirement population. Then the population is survived by multiplying the number of people in each age group by the probability of surviving to the next period, and the population is aged by moving each age group to the following cohort. Next, the submodel calculates the number of births during the period by multiplying the number of women in each age cohort by the probability of a woman bearing a child. Then the military and college migrations are added (subtracted) to the population. At this point the population submodel has accumulated a total population exclusive of net employment-related migration. The military population consists of dependents, who are in the labor force, and inservice personnel, who are not in the civilian labor force.

The Economic Submodel

An earlier version of the model utilized a single equation in an export-base formulation to represent the three major components of economic activity: basic employment, population serving employment, and business serving employment. The current model allows up to 25 industries, each of which may have an industrial serving component, a population serving and a basic growth component. The submodel is defined by a modified input-output table with employment data from the study region, and requires the following information as initial input:

1. An industry-to-industry employment matrix (the amount of employment required in each industry to support levels of employment in each other industry);
2. Total employment by each industry; and
3. Employment supplied to each industry by local residents (which may be lower than total employment, reflecting in-commuting to the study region).

These matrices are combined and reflect the interrelationships among the industries.

The model begins by computing the current available labor force. In determining the available labor force, the labor force participation rates are applied to the resident population. This is added to the labor forces supplied by the college population and military dependents, each with their own separate labor force participation rates. A further adjustment is made for multiple job holding.

The computation of required labor force begins by determining the basic (exogenous) demand of each industry using a simple by growth coefficient (user supplied), and the population induced employment as a (user supplied) percentage of the resident population. The combined change in employment due to the two factors is applied to the in-output equations to determine the direct and indirect effects of this employment on each industry. The sum of these changes across industries reflects the change in employment demand.

Total required employment (the previous employment level plus the change) is then compared to the available labor force, and in-or out-migration takes place in an attempt to bring the unemployment rate within a required range specified for this forecast period by the user.

When migration takes place, the population changes, and consequently, population-related demand changes for each industry.

This new change in demand is applied to the input-output equations and another round of migration takes place. This process continues until a specified maximum number of iterations has taken place during a forecast period, for the unemployment rate falls within user specified bounds.

Summary of the CPEIO Model

The CPEIO model can probably best be summarized by listing the steps within it as they occur:

1. The simulation begins in the population submodel by taking the of initial population data, adding retirement migration, and then projecting the births and deaths that will occur during the period. This information is added to the net non-employment-related college and mitigating migration which has been input to the model yielding the change in the population exclusive of any employment migration.
2. The available labor force is calculated based upon a set of labor force participation rate distribution for the resident college and military dependent populations.
3. The employment submodel then calculated required changes in employment by computing basic employment growth and population-related changes in employment. These are applied to the input-output equation to determine direct plus indirect employment changes.
4. The estimated change in employment is added to old multiple job holding to yield a required labor force.
5. The required labor force is compared to the available labor force and the difference is converted to net employment-related migration based upon the labor force participation rates, the distribution of employment migrants, and the unemployment rates of migrants.
6. The change in the population due to this migration is added to the results from Step 1. However, this incremental change in the population means that the employment will have to be re-evaluated. Consequently, the model will return to Step 3 unless a specified number of cycles have occurred.
7. The final employment and population figures are and become the initial values for the next forecast.

The interrelationships between employment opportunities (and hence, implied employment migration) and changes in the population are embodied in the iterative process in Steps 3 to 6.

As mentioned in the preceding discussion, a number of specific inputs to the CPEIO model were required to generate the population and employment projections which are included in the ES. Fertility and survival rates for each county were obtained from the Colorado Health Department. Labor force participation rates from the 1970 census were used for each county. College-aged populations, where they exist in the ES area, were held constant at their 1977 level. No military population exists in the ES area. In-migration of retired persons was added on a yearly basis according to Colorado Division of Planning estimate.

Changes in employment were inputted to the model on an industry by industry basis for most of the major resource development and reclamation projects in the area. A list of the employment schedules for all those projects included in the mid-level scenario is shown in table R4-8. Assumptions were necessary as to the locally supplied employment from each county for each project. Those assumptions are listed in table G- 1.

These assumptions were based primarily upon three factors: the distance from place of employment (a maximum of 60 minutes average driving time was used for operations worker, and 90 min-

utes for construction workers), the size of communities in the vicinity and their ability to absorb population growth, and the projected overall growth rate for the area.

Besides inputting fixed employment data for these special projects, growth in other industries was accounted for by yearly increases in employment. The yearly growth rates is basic sector employment which were used for each count are comparable to the actual rates from 1970 to 1977. They are listed in table G-2.

TABLE G-1

PERCENTAGES OF LOCALLY-SUPPLIED EMPLOYMENT
FOR NON-COAL-RELATED DEVELOPMENT

Project or Development	County	Percentage
<u>U.S. Bureau of Reclamation projects:</u>		
Dallas Creek	Montrose	70
	Ouray	30
Paradox Valley	Montrose	75
	San Miguel	25
Grand Valley	Mesa	100
Dominguez	Mesa	100
San Miguel	Montrose	50
	San Miguel	50
<u>Oil shale development:</u>		
Rio Blanco (C-A)		
Construction	Garfield	50
	Mesa	25
	Rio Blanco	25
Operation	Garfield	50
	Rio Blanco	50
Colony		
Construction	Garfield	50
	Mesa	50
Operation	Garfield	60
	Mesa	40
Occidental		
Construction	Garfield	50
	Mesa	25
	Rio Blanco	25
Operation	Garfield	50
	Rio Blanco	50
Superior		
Construction	Garfield	50
	Mesa	25
	Rio Blanco	25
Operation	Garfield	30
	Rio Blanco	70
Paraho		
Construction	Garfield	50
	Mesa	50
Operation	Garfield	60
	Mesa	40
<u>Molybdenum mining:</u>		
Amax	Gunnison	100
<u>Power generation:</u>		
Colorado-Ute	Montrose	75
	San Miguel	25

TABLE G-1

PERCENTAGES OF LOCALLY-SUPPLIED EMPLOYMENT
FOR NON-COAL-RELATED DEVELOPMENT
(CONTINUED)

Project or Development	County	Percentage
<u>Uranium mining:</u>		
Pioneer Uravan	Montrose	40
	San Miguel	60
Brooks Minerals	Montrose	80
	San Miguel	20
Cotter Corporation	Montrose	60
	San Miguel	40
Uranium Independents	Montrose	100
Homestake Mining	Chaffee	40
	Gunnison	60
<u>Coal mining:</u>		
Anschutz	Garfield	100
Atlantic Richfield	Delta	100
General Exploration	Garfield	20
	Mesa	80
Mid-Continent	Garfield	20
	Mesa	80
Sheridan Enterprise	Mesa	100
Colorado Westmoreland	Delta	100
Sunflower	Delta	100
U.S. Steel-Somerset	Delta	40
	Gunnison	60
Western Slope Carbon	Delta	90
	Gunnison	10
Quinn	Delta	70
	Montrose	30
Sunlight	Garfield	100
Coal Fules	Mesa	100
Bendetti Brothers	Garfield	100
Empire Energy-Edwards	Delta	100
Western States	Delta	70
	Montrose	30
Bear	Delta	60
	Gunnison	40

TABLE G-2

YEARLY GROWTH RATES

Delta	0.03	Mesa	0.03
Garfield	0.025	Montrose	0.03
Gunnison	0.01	Ouray	0.02

APPENDIX H

RECREATION

Little Bookcliffs Wild Horse Area: Interim Management Guidelines (Whitewater Coal Update Management Framework Plan 1977)

1. Motorized transportation shall be restricted to existing seasonal use and primitive four-wheel drive roads.

2. No new roads shall be authorized within the area. 13. Future development of existing leases for coal and/or oil and gas may entail some construction and other surface disturbing activity. The BLM will impose the strictest possible stipulations on any such development to insure that no unalterable change is made in the character of the land. Mitigating measures will be imposed to bring disturbed areas back to their original state as nearly as possible. Except as outlined under item 8 below, no other construction of any kind will be permitted.

4. Grazing of domestic livestock will be permitted subject to special conditions and restrictions necessary to preserve wildland values.

5. Hunting and fishing are permitted.

6. Motorized equipment will be permitted.

7. Aircraft will be allowed to land in the area.

8. Water storage projects may be permitted under conditions and restrictions deemed necessary to preserve wildland values.

9. Rights-of-way will not be granted.

10. Wildfire will be controlled as necessary to prevent unacceptable loss of wildland values, loss of life, damage to property, and the spread of wildfire to lands outside the study area.

11. Insect and disease control programs shall be permitted to the extent they impact only minimally upon wildland values and other components of the ecosystem.

12. Public use of the area will be permitted consistent with the maintenance of wildland values.

13. Commercial recreation services may be permitted in the area if carefully monitored.

14. Commercial timber harvesting will not be permitted.

15. Mining and prospecting will be permitted.

16. Mineral leasing may be allowed, but surface occupancy will not be permitted.

17. Other proposed uses and programs not specifically mentioned above will be assessed in terms of their possible impacts on wild land and ecologic values. The District Recreation Planner shall assist the Area Manager with the interpretation of the interim management policy.

TABLE H-1

SKI AREAS LISTED ON MAP 16 IN APPENDIX A

Key	Ski Area
1	Aspen Highlands
2	Aspen Mountain
3	Buttermilk
4	Snowmass
5	Sunlight
6	Powderhorn
7	Crested Butte

TABLE H-2

COLORADO DIVISION OF HIGHWAYS REST STOPS
LISTED ON MAP 16 IN APPENDIX A

Key	Rest Stop
A	Hanging Lake
B	French Creek
C	Glenwood Springs
D	Delta-Antelope
E	Rifle

TABLE H-3

NATIONAL FOREST RECREATION SITES LISTED ON MAP 16 IN APPENDIX A

Key	Sites	Key	Sites	Key	Sites
<u>White River National Forest:</u>					
1	Avalanche (CG)	11	Klines Folly (CG)	21	Silver Queen (CG)
2	Bogan Flats (CG)	12	Little Box Canyon (CG)	22	Snowmass Creek (CG)
3	Chapman (CG)	13	Lincoln Gulch (CG)	23	Spruce (PG)
4	Coffee Pot Springs (CG)	14	Lost Man (CG)	24	Supply Basin (CG)
5	Deep Lake (CG)	15	Maroon Lake (CG)	25	Sweetwater Lake (CG)
6	Difficult (CG)	16	Meadow Lake (CG)	26	Three Forks (CG)
7	Elk Wallow (CG)	17	Portal (CG)	27	Trappers Lake (CG)
8	Grizzly Creek (PG)	18	Redstone (CG)	28	Weller (CG)
9	Himes Peak (CG)	19	Silver Bar (CG)	33	Dingle Lake (PG)
10	Janeway (CG)	20	Silver Bell (CG)		
<u>Grand Mesa National Forest:</u>					
29	Bonham Lake (CG)	38	Hay Press (CG)	46	Trickle Park (CG)
30	Carp Lake (CG)	39	Island Lake (CG)	47	Twin Lake (CG)
31	Cottonwood Lake (CG)	40	Jumbo (CG)	48	Valley View (CG)
32	Crag Crest (CG)	41	Kiser Creek (CG)	49	Ward Lake (CG)
34	Eggleston Lake (CG)	42	Little Bear (CG)	50	Ward Way (PG)
35	Fish Hawk (PG)	43	Mesa Lake (PG)	51	Weir and Johnson (CG)
36	Fruita (PG)	44	Spruce Grove (CG)	52	Wild Rose (CG)
37	Glacier Springs (PG)	45	Steamboat Rock (PG)		
<u>Uncompahgre National Forest:</u>					
53	Amphitheatre (CG)	57	Big Cimarron (CG)	62	Divide Fork (CG)
54	Antone Springs (CG)	58	Burro Bridge (CG)	65	Iron Springs (CG)
55	Beaver Lake (CG)	59	Carson Hole (CG)	69	Smokehouse (CG)
56	Big Blue (CG)	60	Columbine (CG)		
<u>Gunnison National Forest:</u>					
73	Agate (CG)	86	Gothic (CG)	99	Pitlin (CG)
74	Almont (CG)	87	Lake Irwin (CG)	100	Dyke Creek (CG)
75	Avery Peak (CG)	88	Lakeview (CG)	101	Quartz (CG)
76	Beaver Ponds (PG)	89	Lodgepole (CG)	102	Rivers End (CG)
77	Cement Creek (CG)	90	Lost Lake (CG)	103	Roosevelt (Group) (PG)
78	Cold Spring (CG)	91	Lottis Creek (CG)	104	Rosy Lane (CG)
79	Comanche (CG)	92	McClure (CG)	105	Smith Fork (CG)
80	Commissary (CG)	93	Mesa Creek (CG)	106	Snow Blind (CG)
81	Dinner Station (CG)	94	Middle Quartz (CG)	107	Soap Creek (CG)
82	Dorchester (CG)	95	Mirror Lake (CG)	108	Spring Creek (CG)
83	Emerald Lake (PG)	96	Mosca (CG)	109	Taylor Canyon (PG)
84	Erickson Springs (CG)	97	North Bank (CG)	110	Timberline Overlook (PG)
85	Gold Creek (CG)	98	One Mile (CG)		

Note: CG = campground; PG = picnic ground; GA = group area

APPENDIX I

TYPICAL DEVELOPMENT OPERATIONS

Exploration, development, production, and reclamation are the four major operations in coal mining. (See U.S. Department of the Interior 1975 and University of Oklahoma 1975 for detailed descriptions of these operations).

Exploration

The nature of the overlying strata, the depth and thickness of the coal deposit, and the quantity of ground water are determined from detailed geologic mapping and drill-hole data. Coal and water samples from the drill hole are analyzed to determine the grade of coal and quality of ground water. A number of exploratory holes are required to delineate the shape of the deposit to determine its size and boundaries. Federal regulations require that all aquifers and workable coal beds encountered in drilling be protected from contamination by oil, gas, water, and other fluid substances and that drill holes be suitably abandoned.

Development

Except for planning the mine, which includes plans for reclamation of mined land and prevention of air and water pollution, actual development cannot begin until all necessary arrangements have been made with federal, state, and local governments, as well as with any private owners of surface and mineral rights. The next step is construction or upgrading of roads for access to selected sites on the mine property and to the coal deposit and construction of utility lines and the mine plant. The mine plant is commonly constructed near the portal of the main drift, slope, or shaft. Mine ventilation fans are installed on the surface. The Sheridan Loma proposal includes construction of a railroad spur. Access to the coal deposits at an underground operation is provided by either drifts, slopes, shafts, or a combination thereof. The coal seam is developed for further operations by driving entries with electrically-powered equipment.

Production

Production is the yield or output of a mine. After the initial development has gained access to the coal seam, one of three methods would be used to extract the coal: room-and-pillar, longwall, or

auger. General Exploration Co. proposes to use room-and-pillar mining; Anschutz Coal Co. and Atlantic Richfield Corp. propose to use longwall methods; Sheridan Enterprises proposes longwall and room-and-pillar methods; and Mid-Continent Coal and Coking Co. proposes longwall methods for Cottonwood Creek and longwall, room-and-pillar, and auger methods for Coal Canyon.

In room-and-pillar mining, a passageway is excavated through the coal seam. From this passageway, rooms are excavated in the coal seam, and the strata above are supported by pillars of coal left in place. Entries are typically driven 20 feet wide; coal pillars are generally rectangular and 80 to 120 feet on a side. The coal is cut off the face of the seam and loaded onto some type of transportation equipment. Most U.S. room-and-pillar mines now employ either conventional or continuous mining methods. (Figure I-1 illustrates the pattern of room-and-pillar mining by both conventional and continuous mining methods.)

In conventional mining, a cutting machine, operating somewhat like a large chain saw, cuts a slice under the seam. A mobile drilling rig then drills blastholes, the coal is fragmented by blasting, and the fragments are picked up by a mechanical loader.

In continuous mining, a single machine (the continuous miner) performs the cutting, loading, and initial transportation operations. This machine cuts the coal off the face of the seam by rotating a drum-shaped cutter. The cutter is mounted above a loading device that pulls the mined coal onto a conveyor belt, which then moves it to the transportation system being used to carry the coal to the surface.

Roof support must be provided for the rooms excavated by either mining method. The system most frequently used involves drilling holes in the roof and inserting bolts equipped with either expansion heads or another fastening system.

Leaving pillars in place to support the roof significantly decreases the portion of the coal that can be mined. On the average, about 45 to 50 percent of the coal in place is recovered in U.S. room-and-pillar mines. This percentage can be increased by removing additional coal when the mine is being closed down and roof support is no longer a prob-

lem. Possibly as much as 80 percent of the coal in place can eventually be recovered by the room-and-pillar method. When subsidence of the ground is permissible, the coal pillars and coal barriers between sections can often be removed, which allows the roof to collapse after the mining operation. Where all of the pillars in the panel area can be recovered, the surface over the panel should subside uniformly.

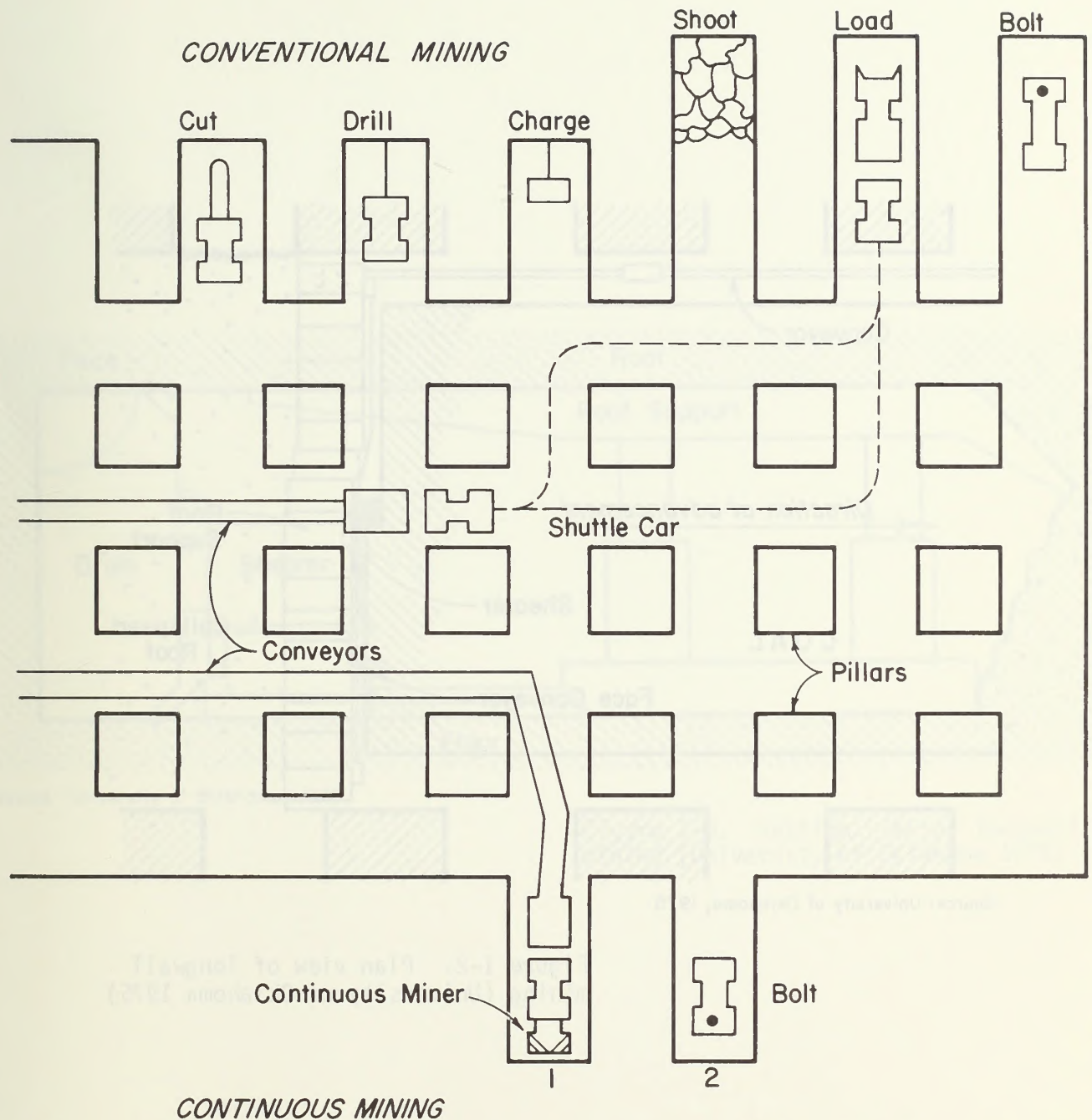
As in the room-and-pillar method, longwall mining starts with sets of entries cut into the panel areas. However, longwall blocks range from 300 to 600 feet wide and are sometimes 1.5 miles long. (This type of operation is illustrated in figure I-2.) A shearing drum moves back and forth across the working face of the seam between two access passageways or galleries. Sheared coal drops onto a conveyor, which moves it to the transportation system being used to remove the coal from the mine. The roof in the area immediately behind the mining machine is held up by hydraulic jacks that are moved forward as the mining operation advances (figure I-3). As the jacks are moved, the roof is allowed to cave behind the advancing work area; the roof is occasionally blasted to ensure a controlled cave-in rate and to reduce overburden pressure on the coalbed being mined. Surface subsidence from longwall mining should be generally uniform over the panels and will occur as mining progresses. Surface subsidence over the entries, however, will not occur until some time after mining has been finished.

Coal mining by the auger method consists of boring horizontal or nearly horizontal holes in an exposed face of coal and loading the coal removed by the auger. Three choices of auger heads, single, dual or triple, are available to remove up to 90 inches of coal for a distance of over 200 feet. Average depth is about 160 feet. Augering is generally used where the terrain is too steep for overburden removal and recovery by underground methods would be impractical or unsafe. In this situation, a bench, wide enough for operating the auger and transporting mined coal, is cut around the hillside at the outcrop. Auger mining is proposed for approximately 40 acres of Mid-Continent's Coal Canyon property. Presumably, auger mining is proposed in the outcrop areas in order to recover additional coal reserves which could not be recovered by underground mining because of poor roof conditions along the outcrop.

Reclamation

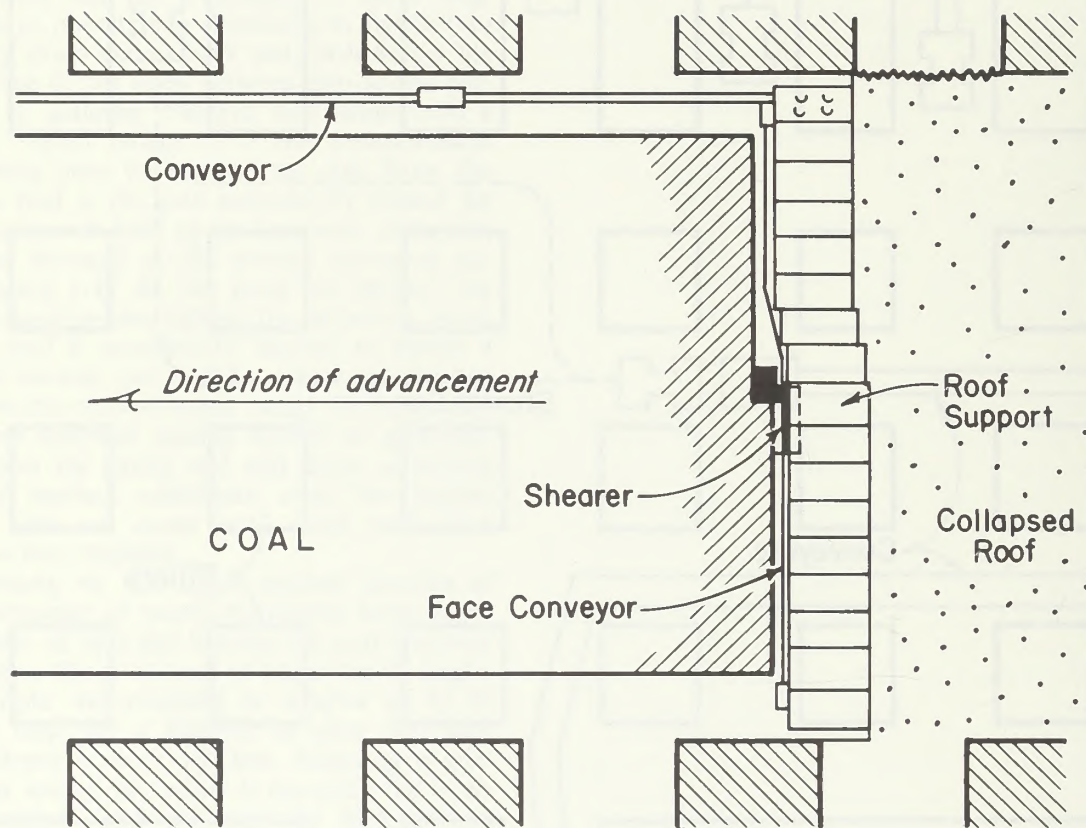
In the past, little or no reclamation was applied to disturbances associated with underground mines. However, federal coal leases now require reclamation of current mines when they are abandoned. Reclamation of underground mines usually in-

volves removal of all equipment and facilities and regrading and reseeding of disturbed areas. All surface openings are permanently sealed and subsidence holes filled in.



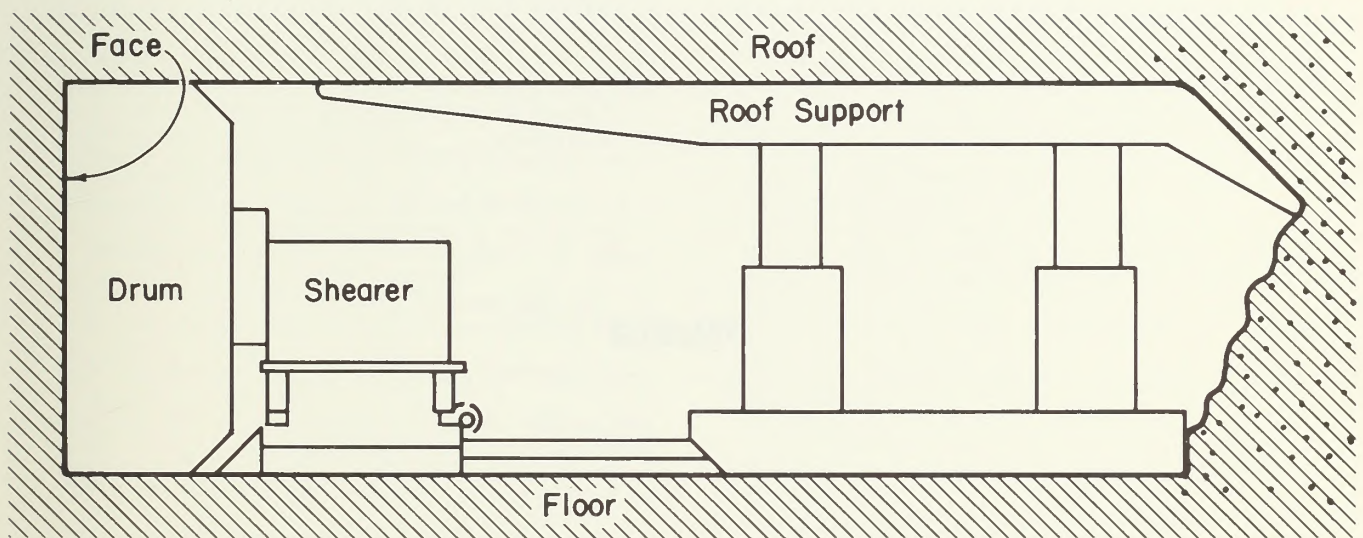
Source: University of Oklahoma, 1975

Figure I-1. Alternative methods for room-and-pillar mining (University of Oklahoma 1975)



Source: University of Oklahoma, 1975

Figure I-2. Plan view of longwall mining (University of Oklahoma 1975)



Source: University of Oklahoma, 1975

Figure I-3. Section view of longwall mining (University of Oklahoma 1975)

GLOSSARY

- ACCELERATED EROSION.** Erosion much more rapid than normal, natural, geological erosion; primarily as a result of the influence of the activities of humans or, in some cases, animals.
- ACID MINE DRAINAGE.** Any acid water draining or flowing on, or having drained or flowed off, any area of land affected by mining.
- ACRE-FOOT.** A term used in measuring the volume of water, equal to the quantity required to cover 1 acre 1 foot in depth, or 43,560 cubic feet.
- AD VALOREM.** In proportion to the value.
- AEROSOLS.** Dispersed solid (or liquid) matter in a gaseous medium.
- AIR POLLUTION DISPERSION POTENTIAL.** A qualitative assessment of the likelihood that a pollutant released into the atmosphere will be dispersed (diluted). See Mixing Height, Transport Winds, Ventilation.
- AIRSHEDS.** These are areas in which weak dispersion conditions result from the effects of obstructions on the normal wind flow pattern. These obstructions are elevated topographic features, such as mountain ranges or canyon walls.
- ALLUVIAL.** Pertaining to or composed of any sediment deposited by flowing water (alluvium), as in a river bed.
- ALLUVIUM.** A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay, and all variations and mixtures of these; unless otherwise noted, alluvium is unconsolidated.
- AMBIENT.** The natural conditions (or environment) at a given place and time.
- AMBIENT AIR QUALITY.** The state of the atmosphere at ground-level as defined by the range of measured and/or predicted ambient concentrations of all significant pollutants for all averaging periods of interest.
- AMBIENT CONCENTRATIONS.** Ground-level pollutant concentrations resulting from all anthropogenic and natural pollutant sources.
- ANASAZI.** Prehistoric Indians who inhabited the Four Corners area, ca A.D. 700-1300.
- ANCHOR BOLTS.** A foundation bolt; a drift spike or other device used for holding any mechanism or structure down.
- ANCILLARY FACILITIES.** See SUPPORT FACILITIES.
- ANGLE OF DIP.** The angle an inclined stratum makes with the horizontal.
- ANIMAL UNIT.** Considered to be one mature cow with calf or their equivalent based upon average daily forage consumption of 26 pounds of dry matter per day.
- ANIMAL UNIT MONTH (AUM).** The amount of feed or forage required by an animal unit for 1 month.
- ANTICLINE.** An elongate fold in the rocks that inclines downward from both sides of a median line or axis.
- AQUIFER.** A water-bearing bed or stratum (layer) of permeable rock, sand, or gravel capable of yielding considerable quantities of water.
- ARCHEOLOGICAL RESOURCES.** Sites, areas, structures, objects, or other evidence of prehistoric human activities.
- ASPECT.** The direction that a slope faces.
- ATMOSPHERIC DISPERSION MODEL.** A
- DEMOGRAPHY.** The science of vital statistics, as of births, deaths, marriages, etc., of populations.
- DEPOSITION.** 1. The laying down of potential rockforming material. The precipitation of dissolved or suspended matter to the bottom of a body of water. 2. The depletion of particulate matter from a dispersing pollutant plume due to gravitational settling, surface impaction, electrostatic attraction, and absorption.
- DEVONIAN.** A period of the Paleozoic era, thought to have included the span of time from 395 million years ago to 345 million years ago.
- DEW POINT.** The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur.
- DEWATER.** To remove water from; dehydrate.
- DISPERSION.** The distribution or dilution of a given quantity of pollutant in an increasing volume of atmosphere. Dispersion is regulated mainly by the intensity of the turbulent mixing of the air with only a slight contribution from molecular diffusion.
- DISPERSION SUB-AREA.** A geographical region such as a valley or canyon with similar atmospheric dispersion patterns throughout.
- DISSOLVED OXYGEN.** The amount of dissolved oxygen, in parts per million by weight, present in water, now generally expressed in milligrams per liter. A critical factor for fish and other aquatic life, and for self-purification of a surface-water body after inflow of oxygen-consuming pollutants.
- DISSOLVED SOLIDS.** A term that expresses the quantity of dissolved material in a sample of water. The term total dissolved solids (TDS) is used to designate the sum of all dissolved constituents.
- DISTURBED LAND.** Land on which excavation has occurred or upon which overburden has been deposited, or both, or where vegetative cover has been partially or totally removed.
- DOWNSLOPE FLOW.** A wind blowing downhill or downvalley.
- DROUGHT.** A period of abnormally dry weather sufficiently prolonged for the lack of water to cause a serious hydrologic imbalance (i.e., crop damage, water-supply shortage, etc.). A year during which the precipitation measures 75% or less of the normal annual precipitation is sometimes called a drought year.
- DUST.** Solid materials suspended in the atmosphere in the form of small irregular particles, many of which are microscopic in size.
- DUSTY CONDITIONS.** These conditions are reported whenever the visibility is reduced to seven miles or less by either dust, blowing dust, or blowing sand.
- ECOSYSTEM.** Complex self-sustaining natural system, which includes living and nonliving components of the environment, and the interactions that bind them together. Its functioning involves the circulation of matter and energy between organisms and their environment.
- EFFLUENT.** Liquid wastes (as industrial refuse or sewage) discharged into the environment.
- EMISSION FACTOR.** An empirically derived mathematical relationship between pollutant emission rate and some characteristic of the source such as volume, area, mass, or process output.

ENVIRONMENT. Sum of all external forces, substances, or conditions that affect organisms in any way.

EOCENE. Pertaining to an epoch of the Tertiary period, occurring from 40 million to 60 million years ago.

EPHEMERAL STREAM. A stream or reach of a stream that flows only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.

EROSION. The process by which the surface of the earth is worn away by the action of water, glaciers, winds, etc.

EUTROPHICATION. A state in which there is an abundant accumulation of nutrients that support a dense growth of plant and animal life, the decay of which depletes the shallow water of oxygen in the summer.

EVAPORATION. The physical process by which a liquid or solid is transformed to the gaseous state.

EVAPOTRANSPIRATION. The combined loss of water from a given area during a specific period of time, by evaporation from the soil surface and by transpiration from plants.

FACE. The solid surface of the unbroken portion of the coal bed at the advancing end of the working machinery.

FAULT. Breaks in the continuity of the body of rock, with dislocation along the plane of fracture.

FEE COAL. Privately owned coal rights.

FLUVIAL. Formed or produced by the action of flowing water.

FOOTWALL. The wall (bottom of a coal seam, floor) upon which a miner stands.

FORAGE. All browse and herbaceous food that is available to livestock or game animals.

FORB. A broadleaved herb; a weed.

FREMONT CULTURE. Prehistoric Indians who inhabited the Great Basin area.

FUGITIVE DUST. A type of particulate emission made airborne by forces of wind, man's activity, or both, such as unpaved roads, construction sites, tilled land, or windstorms.

GAUGING STATION. A particular site on a stream, or reservoir where systematic observations of gauge height, discharge, or water quality parameters (or any combination of these) are or have been obtained. Usually equipped with a device to automatically record the gauge height of the stream.

GAUSSIAN DISTRIBUTION. A theoretical frequency distribution represented by a normal, bell-shaped cone.

GIRDLING. To cut away the bark in a ring around (a branch, tree, etc.).

GOB. A pile of loose waste from or in a mine or backfill waste packed in working to support the roof.

GRANITE. A coarse-grained, light-colored, hard igneous rock.

GRAZING. Consumption of range or artificial pasture forage by animals.

GRAZING ALLOTMENT. An area designated for the use of a prescribed number and kind of livestock under one plan of management.

GRAZING CAPACITY. See CARRYING CAPACITY.

GRAZING DISTRICT. An administrative unit of federal range established by the Secretary of the Interior under the provisions of the Taylor Grazing Act of 1934, as amended.

GROUND WATER. That part of the subsurface water that is the zone of saturation.

GROWING SEASON. Generally, the period of the year during which the temperature of cultivated vegetation remains sufficiently high to allow plant growth.

GUNITE. A mixture of cement, sand, or crushed slag and water, sprayed over reinforcement as a lightweight concrete construction.

HABITAT. The natural abode of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting life.

HAIL. Precipitation in the form of balls or irregular lumps of ice, always produced by convective clouds, nearly always cumulonimbus (thunderstorm cloud).

HAZE. Fine dust or salt particles dispersed through a portion of the atmosphere. The particles are so small that they cannot be felt or individually seen with the naked eye, but they diminish horizontal visibility.

HISTORICAL RESOURCES. Sites, districts, structures, objects, or other evidence of human activities that represent the facets of the history of a nation, state, or locality.

HOLOCENE. Recent.

HYDRAULIC. Involving, moved, or operated by fluid, especially water, under pressure.

HYDROLOGIC IMBALANCE. The alteration of the normal water cycle, such as that produced during a DROUGHT or a very wet period. In the case of the former, a water-supply shortage results as well as crop damage.

HYDROLOGIC SOIL GROUP. A class of soils which have similar general infiltration and water movement ability through the soil profile and bedrock.

IGNEOUS. Produced under conditions involving intense heat, as rocks of volcanic origin or rocks crystallized from molten magma.

INTERCEPTOR SEWERS. A sewer line to connect sewage collection systems to a sewage plant, it is outfall from the treatment plant to the receiving body. A sewer which does not collect from a residence.

INTERMITTENT STREAM. A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and is dry for a large part of the year.

INTERSTITIAL POROSITY. Transmitted through interconnected pore space between grains within the sedimentary bedrock.

INTRODUCED SPECIES. A species not a part of the original vegetation or wildlife of an area.

INVERSION. An anomalous (abnormal) condition in the lower atmosphere in which temperature increases with increased elevation (normally temperature decreases with increased elevation).

INVERTEBRATE. An animal without a backbone. This group includes such animals as insects, clams, snails, and worms.

ISOHYET. ISOPLETH of precipitation amounts.

ISOPLETH. A line on a map connecting points at which a given variable has the same value. An isopleth of precipitation is called an isohyet.

ISOTHERM. An ISOPLETH of temperature.

JIG. A machine in which the feed (mined coal) is stratified in water by means of a pulsating motion and from which stratified products are separately removed.

JIGGING. Up and down motion of a mass of particles in water by means of pulsation.

JURASSIC. The second period of the Mesozoic era, thought to have included a span of time from 195 or 190 million years to 136 million years ago.

KERF. Undercut in coal seam from 3 to 7 inches thick and entering the face to a depth of 4 to 7 feet; made by a mechanical cutter.

LEASE AREA. The area or acreage of federal minerals within the project area which would be leased. Different from public lands.

LITHIC CONTACT. A boundary between soil and continuous, coherent underlying material which has a hardness of 3 or more (Mohs Scale). When moist, the underlying material cannot be dug with a spade and chunks will not disperse in water with 15 hours shaking.

LITHIC SCATTER. Stone debris left as the result of tool manufacture or reshaping.

LITHOLOGY. The description of rocks.

LONGWALL. Pertaining to a means of extracting coal or other minerals in an underground mine from a continuous face. See appendix I, Typical Development Operations.

- MEAN ANNUAL TEMPERATURE.** The average yearly temperature at a site, computed by the averaging of daily maximum and daily minimum temperatures during each year for numerous years of data.
- MEAN MONTHLY TEMPERATURE.** The average monthly temperature at a site, computed by the averaging of daily maximum and daily minimum temperatures during each month for numerous months of data.
- MEAN RECURRENCE INTERVAL.** The average time it takes before a certain event occurs again. This is applied to such parameters as strong winds and heavy rainfall.
- METAMORPHIC.** Pertaining to structural change or metamorphism due to natural agencies as pressure and heat, especially when rock becomes harder and more completely crystalline.
- MINE BENCH.** One of two or more divisions of a coal seam separated by slate or simply separated by the process of cutting the coal.
- MINE DRAINAGE.** Any water forming on or discharging from a mining operation. May be alkaline or acid in nature.
- MINE FACILITIES.** An area within the project area upon which all buildings and other facilities that are used for mine administration and coal processing or handling are constructed. It includes that portion of the access road and railroad spur (loop) that is within the project area.
- MINE MOUTH.** The end of a shaft, adit, drift, entry, tunnel, etc., emerging at the surface.
- MINING AREA.** The area within the project area that would be disturbed by mining operations; includes haul roads.
- MIOCENE.** Pertaining to an epoch of the Tertiary period, occurring 20 million to 25 million years ago.
- MISSISSIPPIAN.** A period of the Paleozoic era, thought to have included a span of time from 345 million to 320 million years ago.
- MIXING HEIGHT.** The height above the ground to which turbulence causes the air to be well mixed.
- MODELING.** A mathematical or physical representation of an observable situation. In air pollution control, models afford the ability to predict pollutant distribution or dispersion from identified sources for specified weather conditions.
- MONOCLINE.** A structure of a fold dipping in only one direction.
- MONOLITH.** Single block or piece of stone of considerable size.
- MUDSTONE.** A clayey rock of nearly uniform texture throughout, with little or no lamination.
- NATIONAL REGISTER.** The National Register of Historic Places, which is a register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture, maintained by the Secretary of the Interior.
- OFF-ROAD VEHICLE (ORV).** Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other terrain.
- OLIGOCENE.** Pertaining to an epoch of the Tertiary period, occurring from 25 million to 40 million years ago.
- ORDOVICIAN.** A period of the Paleozoic era, thought to have included the span of time from 500 million years ago to about 430 or 440 million years ago.
- ORGANIC MATERIAL.** Material consisting of naturally occurring carbonaceous and biologically-derived substances; e.g., wood, bone, or feces.
- OROGENIC.** Refers to the process of mountain building, especially by folding and faulting of the earth's crust.
- OROGRAPHIC LIFTING.** The vertical movement of air as a result of the deflecting influence of a topographical barrier (such as a mountain) on a horizontally moving stream of air.
- OUTCROP.** Coal which appears at or near the surface; the intersection of a coal seam with the surface.
- OVERBURDEN.** The earth, rock, and other materials that lie above a mineral deposit.
- PALEOCENE.** Pertaining to an epoch of the Tertiary period occurring from 60 to 20 million years ago.
- PALEOZOIC.** One of the major eras of geologic time lasting about 400 million years and believed to have begun at about the beginning of life on earth.
- PANEL.** A large rectangular block or pillar of coal.
- PARTICULATES.** Any liquid or solid particles suspended in or falling through the atmosphere.
- PENNSYLVANIAN.** A period of the Paleozoic era, occurring from 320 million years to 280 million years.
- PERMIABILITY.** Capacity for transmitting a fluid.
- PERMIAN.** The last period of the Paleozoic era, thought to have included the span of time from 280 million years ago to 225 million years ago.
- PERENNIAL STREAM.** A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream. Syn: permanent stream; live stream.
- PERIOD.** A unit of geologic time; the fundamental unit of the standard geologic time scale.
- pH.** The logarithm of the reciprocal of the hydrogen-ion concentration. Water is considered to be neutral at a pH of 7, acid if pH is less than 7, and basic if greater than 7.
- PLEISTOCENE.** Pertaining to the epoch forming the earlier half of the Quaternary, originating about 1 million years ago.
- PLIOCENE.** Pertaining to an epoch of the Tertiary occurring from 1 million to 10 million years ago.
- POINT SOURCE.** A pollutant source whose origin of emissions can be approximated by a single point.
- POLLUTANT.** Anything that pollutes; especially, any gaseous, chemical, or organic waste that contaminates air, soil, or water.
- POLLUTION.** The contamination of soil, water, or the atmosphere by the discharge of noxious substances.
- PRECIPITABLE WATER.** The total atmospheric water vapor contained in a vertical column of unit cross-sectional area extending between any two specified levels (such as surface to 20,000 feet), commonly expressed in terms of the height to which that water substance would stand if completely condensed and collected in a vessel of the same unit cross-section.
- PREDICTED CONCENTRATIONS.** Ground-level atmospheric pollutant levels calculated using atmospheric dispersion models.
- PREVAILING WIND.** The most frequent compass direction from which the wind blows.
- PRIMITIVE AREA.** Area in which no commercial development or use is permitted and no routes for motorized transportation are developed.
- PUBLIC LANDS.** Any land and interest in land owned by the United States within the several states and administered by the Secretary of the Interior through the Bureau of Land Management, without regard to how the United States acquired ownership, except (1) lands located on the Outer Continental Shelf; and (2) lands held for the benefit of Indians, Aleuts, and Eskimos.
- QUATERNARY.** The second period of the Cenozoic era.
- RADIATIONAL COOLING.** The cooling of the earth's surface and adjacent air, accomplished (mainly at night) whenever the earth's surface suffers a net loss of heat.
- RAPTORS.** An order of birds including all birds of prey, such as the eagle, hawk, owl, and vulture.
- RECEPTOR.** An imaginary point for which pollutant concentrations are predicted.
- RECHARGE.** Inflow to a ground water reservoir (aquifer system in which ground water is stored).
- RECLAMATION.** The process of returning disturbed lands to their former uses or other productive uses.

- RECREATION RESOURCES.** Any natural resource or feature that contributes to outdoor leisure pursuits or experiences.
- RECURRENCE INTERVAL.** See **MEAN RECURRENCE INTERVAL.**
- REGIONAL VISIBILITY.** Visibility predicted to occur in the region around a source or group of sources resulting from annual average particulate concentrations in the vicinity of these sources.
- RELATIVE HUMIDITY.** The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.
- RELIEF.** The variations in elevation of any area of the earth's surface.
- REVEGETATION.** The reestablishment or improvement of vegetation through either natural or mechanical means, i.e., natural revegetation or artificial revegetation.
- RIDER SEAM.** A small seam of a mineral, especially coal, lying not far above a larger seam.
- RIPARIAN.** Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along streams, around springs, etc.
- RIPRAP.** A foundation or sustaining wall of stones thrown together without order. It is used to fill roadways and on embankments.
- ROCK.** Any naturally formed, consolidated or unconsolidated material, other than soil, composed of mineral constituents.
- ROOM-AND-PILLAR.** A system of mining in which the coal or ore is mined in rooms separated by narrow ribs or pillars. The coal or ore in the pillars is won by subsequent working in which the roof is caved in successive blocks. See appendix I, Typical Development Operations.
- RUNOFF.** That portion of the rainfall that is not absorbed by the deep strata: it is utilized by vegetation or lost by evaporation or may find its way into streams as surface flow.
- SALINE SOIL.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.
- SANDSTONE.** A medium-grained, fragmental sedimentary rock composed of abundant and rounded or angular fragments of sand size set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate); the consolidated equivalent of sand.
- SEAM.** A stratum or bed of coal.
- SEDIMENT.** The relatively fine material that settles to the bottom of a waterway. Material less than 3 millimeters in diameter is of particular concern because of its adverse effects on aquatic life.
- SEDIMENT YIELD.** The average amount of soil moved from a given point to another point as a result of runoff.
- SEDIMENTARY ROCKS.** Rocks formed from sediment or from transported fragments deposited in water.
- SEMIARID CLIMATE.** In Thornwaite's 1931 climatic classification, a humidity province whose principal plant life is short, drought resistant grasses. Koppen called these conditions the 'steppe climate'. Semiarid regions are highly susceptible to severe drought.
- SETTLING POND.** A pond, natural or artificial for recovering the solids from washery effluent.
- SHALE.** A fine-grained, indurated, detrital sedimentary rock formed by the consolidation (as by compression or cementation) of clay, silt, or mud, and characterized by finely stratified (laminae 0.1 to 0.4 mm thick) structure and/or fissility that is approximately parallel to the bedding (along which the rock breaks readily into thin layers), and that is commonly most conspicuous on weathered surfaces, and by a composition with an appreciable content of clay minerals or derivatives from clay minerals, and with a high content of detrital quartz.
- SILTSTONE.** A very fine-grained sandstone, mainly consolidated silt.
- SILURIAN.** A period of the Paleozoic era, occurring from 400 million to 440 million years ago.
- SITE-SPECIFIC.** A specific project area analyzed with the environmental statement.
- SIX-HOUR/100-YEAR STORM.** A storm that occurs on the average of every 100 years and lasts six hours.
- SLACK.** Fine-grained coal material resulting from weathering, screening, or washing of coal. It has a high ash content and is generally 1 inch or less in diameter.
- SLOUGHING.** Crumbling slowly and falling away.
- SOIL ASSOCIATION.** A group of defined and named taxonomic soil units occurring together in individual and characteristic patterns over a geographic region.
- SOIL BIOTA.** The animal and plant life of the soil; flora and fauna collectively.
- SOIL PRODUCTIVITY.** The capacity of a soil in its normal environment for producing a specified plant or sequence of plants under a specified system of management.
- SOIL STRUCTURE.** The combination or arrangement of primary soil particles (sand, silt, clay) into secondary particles, units, or peds. The secondary units or soil aggregates are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively.
- SOIL TEXTURE.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying 'coarse, fine, or very fine.'
- SOLAR RADIATION.** The total electromagnetic radiation emitted by the sun. The amount that reaches the earth's surface is modified by passage through the atmosphere.
- SPECIES COMPOSITION.** The relative proportion of various plants species in the total cover on a given area.
- STEADY-STATE GAUSSIAN DISPERSION EQUATION.** A formula relating vertical and horizontal pollutant concentration distributions to source strength, source geometry and meteorological conditions. This equation is based on the assumption of Gaussian or normal concentration distributions in the vertical and horizontal cross wind directions and the assumption of non-varying meteorological and source conditions.
- STRATIGRAPHY.** The study of rock strata.
- STREAM(S).** Any body of running water, great or small, moving under gravity flow to progressively lower levels in a relatively narrow but clearly defined channel on the surface of the ground.
- STREAM FLOW.** Water flowing within a stream channel.
- STRIP MINE.** Refers to a procedure of mining which entails the complete removal of all material from over the product to be mined in a series of rows or strips; also referred to as 'open pit, open cut, or surface mine.'
- STRIP MINING.** See **SURFACE MINING.**
- STRIPPING.** The removal of earth or nonore rock materials as required to gain access to the ore or mineral materials wanted. The process of removing overburden or waste material in a surface mining operation.
- STRUCTURE.** Any visible signs of displacement or deformation of the rock such as faulting or folding.
- SUBBITUMINOUS.** Nonagglomerating coal having a heat value of 8,300 to 13,000 BTUs on a moist, mineral-matter free basis. Intermediate in rank between lignite and bituminous coal.
- SUBCLIMAX.** A stage or community in an ecological succession immediately preceding a climax.
- SUBSIDENCE.** A sinking down of a part of the earth's crust. Lowering of the strata, including the surface, due to underground excavations.

SUBSTRATE. The base or material on which an organism lives.

SUPPORT FACILITIES (or ANCILLARY FACILITIES). An all inclusive term used to cover all railroad spurs, access roads, power lines, conveyor systems etc., that are constructed outside the project area.

SURFACE MINING. Mining method whereby the overlying materials are removed to expose the mineral for extraction.

SURFACE RUNOFF. The runoff that travels over the soil surface to the nearest surface stream, runoff of a drainage basin that has not passed beneath the surface since precipitation. The term is misused when applied in the sense of direct runoff.

SURFACE WATER. Waters on the surface of the earth, including water in streams, lakes, ponds, ice, snow, glaciers, etc.

SYNCLINE. An elongate fold in the rocks that inclines upward.

SYNOPTIC-SCALE. The scale of high and low pressure systems in the lower layers of the atmosphere. This scale is generally considered to range from 600 miles to 1,500 miles.

TALUS. Sloping mass of rocky fragment at the base of a cliff.

TERTIARY. The first period of the Cenozoic era, thought to have included the span of time from 65 million years ago to about 2 to 1 million years ago.

TERRACE. (1) An embankment or combination of an embankment and channel constructed across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope. (2) A level, usually narrow plain bordering a river, lake, or sea. Rivers sometimes are bordered by terraces at different levels.

THICKENER. Large circular tank in which solids settle slowly and form a slurry which is continuously removed from below while fairly clean water overflows.

THRUST FAULT. A fault having a dip of 45 degrees or less in which the overlying side appears to have moved upward relative to the underlying side.

TOPOGRAPHIC ADJUSTMENT. The construction of ISO-PLETHS for a certain parameter (such as temperature, precipitation, or snowfall) by the combined use of both TOPOGRAPHICAL DATA and data for that parameter.

TOPOGRAPHICAL. Of, relating to, or concerned with the configuration of the terrain.

TOPOGRAPHY. The exact physical features and configuration of a place or region; the detailed and accurate description of a place or region.

TOPSOIL. The original or present dark-colored upper soil (A horizon) that ranges from a mere fraction of an inch to 2 or 3 feet thick on different kinds of soil.

TOTAL SUSPENDED PARTICULATES. The portion of the total particulate matter in the atmosphere consisting of particles so small that the particles settle out very slowly.

TRANSPORT WIND. The average horizontal wind speed component perpendicular to a vertical cross section of the atmosphere. In this report, the vertical limits are defined by the ground and the mixing height.

TRIASSIC. The first period of the Mesozoic era, thought to have included the span of time from 225 million years ago to about 195 to 190 million years ago.

TURBIDITY. The quality of opaqueness due to the presence of suspended material. It is commonly expressed in Jackson Turbidity Units (JTU). These units are roughly proportional to milligrams per liter of suspended sediment: a range in JTU of 3 to 440 corresponds to a range in concentration of suspended sediment of about 5 to 1,000.

TURBULENCE. A state of fluid flow in which the instantaneous velocities exhibit an irregular pattern and apparently random fluctuations.

UNDIFFERENTIATED HIGHLANDS. Same as highland climate or mountain climate. Very generally, the climate of relatively high elevations. Mountain climates are distinguished by the departure of their characteristics from those of surrounding lowlands, and the one common basis for this distinction is that of atmospheric rarefaction. Aside from this, great variety is introduced by differences in latitude, elevation, and exposure to the sun. Thus, there exists no single, clearly defined mountain climate.

UPSLOPE FLOW. A wind blowing toward higher elevations.

VEGETATION CONVERSION. Replacing one vegetative type with another by means of chemical, mechanical, or some other treatment.

VEGETATIVE COMPOSITION. The proportion of the total vegetative density provided by each species, expressed in percent.

VEGETATIVE DENSITY. As viewed from above, the percent of ground cover for the current year's growth of all usable vegetation.

VENTILATION. A measure of the amount of air moving through a vertical cross-section of the atmosphere. The higher the ventilation, the higher the DISPERSION. As used in this report, it is the product of the MIXING HEIGHT and the TRANSPORT WIND.

VISIBILITY. A measurement of the maximum distance to which large objects may be viewed. Fixed reference objects such as mountains, hills, towers, or buildings are normally used to estimate visibility.

VISUAL RANGE. Measured or predicted visibility obtained by means other than the direct visual observation of visibility.

VISUAL RESOURCE. The scenic quality of a landscape that is derived from landforms, vegetation, water, cultural modifications, and adjacent scenery.

VISUAL RESOURCE MANAGEMENT CLASSES. Classification of landscapes according to the kinds of artificial structures and modifications which are acceptable to meet established visual goals.

VOLATILE. Readily vaporized at a relatively low temperature.

WASHERY. That part of a preparation plant where merchantable coal is separated from the refuse by using differences in specific gravity.

WATER RESOURCES. A general term referring to the total availability of water on or in the ground for use by animals or people.

WATERSHED. The region draining into a river, river system, or body of water.

WATER TABLE. The surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere. Synonyms: water level, ground water level.

WATER-TABLE AQUIFER. Unconfined aquifer.

WATER SUPPLY. A source or volume of water available for use; also, the system of reservoirs, wells, conduits, treatment facilities, etc., required to make the water available and usable; often but not always equivalent to water resources.

WESTERLIES. Specifically: the dominant west-to-east motion of the atmosphere, centered over the middle latitudes of both hemispheres.

WICKIUP. A frame hut covered with matting, bark, brush, or the like, used by the nomadic Indians of North America.

WIND ROSE. A graphical display of wind speed and wind direction frequencies at a meteorological station. The bar graphs extend into the direction from which the wind blows. These directions are the sixteen compass-point directions (i.e., north, north-northeast, northeast, northwest, and north-northwest).

WINTER RANGE. That area occupied by a species during the winter months.

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